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ELECTRICAL WORLD AND ENGINEER.

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ASSOCIATION MEMBERSHIP.

Since his election to the presidency of the National Electric Light Association, Mr. J. B. Cahoon has been distinguishing himself by making a vigorous campaign for new members. It has already yielded good results, and we are glad to learn from the documents sent us from the association office that the work is to be continued. We have been asked to help it along, and do so most heartily. The association has been very useful in the past, and has many opportunities in the future, but it cannot live up to those opportunities without membership. We have often been surprised that the accessions were not larger. In our report last week of the meeting of the Edison Association, attention was called to the large percentage it had enrolled of possible members, and it might have been added that, as to capital represented, the percentage runs even higher. The National Electric Light Association has always included several of the larger companies, but it can never be as influential as it ought to be until scores and scores of the smaller companies that have never yet participated show up at the annual meetings.

The membership fee is so small, it ought not to stand in the way of any one. It is possible that many officials think it is enough to read the reports in our columns. This is not so, for it is what is picked up outside the convention hall that often has the most value and benefit in the exchange of experience and practice. Where a number of smaller companies have been syndicated, the reasons for membership are no less strong, and we should regard it as shrewd business policy for such concerns to send their central and local executives to every annual meeting. There is also an indirect effect to be considered. The association can be made at any time the mouthpiece and the safeguard of the vast interests represented in its title, but any declaration would come with much more force from a membership of five hundred or a thousand than from one of two hundred. Even five hundred companies in membership would be a bare 20 per cent of the possible. We trust, therefore, that Mr. Cahoon's campaign may continue to bear good fruit in recruits who will swell the ranks and carry the association forward with a prestige unequaled in the past.

PHOTOMETRY.

No actions were taken at the Paris Electrical Congress this year in the direction of photometry. The fact is, that certain past actions in this direction are somewhat of a dead letter. The unit of luminous intensity is still officially the violle or luminous intensity emitted normally by a square centimetre of platinum at the temperature of solidification; and the secondary unit representing the violle, the one-twentieth part, or bougie decimale, is also the official secondary luminous intensity. The violle, however, seems to be very rarely employed, and even the bougie decimale, its supposed more practical representative, is hardly ever used. The whole system of photometric units is still in a very chaotic state. A paper on the subject was communicated to the Paris Electrical Congress by M. Violle. This paper still advocates the use of the violle platinum standard. It intimates that the degree of accuracy of which that standard is capable is much greater than is generally supposed. It also favors the development and realization of an arc-light standard of luminous intensity.

The real difficulty in the way of an arc-light standard may lie in the absorption by the vapor of the arc. That is to say, the variations which are observed in the luminous intensity of the arc crater may

not be attributable to the conditions at the crater surface, where the intensity emitted may possibly be very nearly uniform, but may be due to the absorption of the layer of arc vapor always present between the crater and the photometer screen, which layer is never quite steady or of constant thickness. If, therefore, this variable absorption could be eliminated, it is possible that the crater luminous intensity standard would be much more closely reliable than it is at present.

The Hefner-Alteneck lamp is the best standard of luminous intensity that we possess to-day, but unfortunately it is not white, but colored, and its red color is very unfavorable to accurate comparisons with luminous intensities of whiter hue. Nevertheless, it seems to be the only light source which is sufficiently definite and reliable to permit of corrections for local atmospheric conditions. Whatever possibilities may exist for accurate work with the acetylene flame, there has as yet been but little done in that direction to establish confidence.

DOMESTIC POSSIBILITIES.

It is an undeniable fact that if electrical applications were pushed more actively than they are, the trade in them would be even more active than it is. We do not mean that the day is to be expected or hoped for when push buttons will be hawked on the street and telephones sold from door to door, but there is a great deal of work to be done in familiarizing the public with the idea that the innumerable electrical appliances of modern times are for use and not mere objects of marvel.

We publish a brief article this week in which one of our readers tells of his experiences in finding anywhere in his vicinity—in New England—a house that afforded even the rudimentary comforts possible with the electric light. There is nothing particularly new or novel about the points that Mr. Hale makes, for such things as he suggests are done, but there is plenty of food for thought that nowhere in this country are such conveniences as he sums up neatly to be found in ordinary houses. This article, like those of Dr. Louis Bell on the principles of illumination, must lead to the conviction that the work of introducing the electric light intelligently and scientifically into domestic interiors has but barely begun.

ELECTRIC FOUNTAINS.

The Château d'Eau is the most spectacular piece of architecture and illumination at the Paris Exposition, and in many ways it arouses the curiosity and admiration of the visitors. This Water Palace is not a part of Electricity Building, nor can it be in any way dissociated from it. It is not a separate structure, yet it will probably remain in some way as such after the Exposition is over, as a large part of it is solid masonry. It is not a cascade, nor is it a mere fountain in the ordinary meaning of the word. It is a purely decorative effect by day and night, and yet it is an integral part of the prosaic, utilitarian water supply for the service steam plant.

The French architects and engineers who have carried out this work have triumphed very fairly, however, over all the difficulties created by awkward location, clashing conditions and the dual requirements of daylight and darkness. We publish this week an article giving in thorough detail the manner in which the façade and bed of this Water Palace are illuminated. It will be remembered that this is a field in which there have already been some notable achievements in this country and Europe; so that this last effort had to submit to critical comparison with some brilliant and grandiose predecessors. We are glad to be able to congratulate the electrical engineers who did the work on a most charming result, which will long dwell in the memory as one of the most beautiful of the spectacles of the last great Exposition of this century.

COPPER VERSUS COAL

The recent high price of coal in England, the scarcity of that fuel in Europe, and now the mining troubles in our own country, serve to direct attention to water powers and their utilization. It is a moot question whether coal will ever be much cheaper than it now is in Europe, even if this country should flood the market there with it, and after all is said and done, the water powers of the Old World are neither very large nor very numerous. Undoubtedly they will be further developed and economized, but never sufficiently, it is to be feared, to make any material impression on the price of coal.

In the United States and Canada, the supply of water power, like that of coal, appears at present illimitable. Canada is reported to have available 50,000,000 horse-power, and in this country the figure is 200,000,000 horse-power, of which some 4,000,000 is now in use. The practical development of much of this wasted energy is likely to be seen in the near future, and if it were turned loose on our railroads as well as on our various power-consuming industries—which means all of them—it might make some difference in coal consumption and in the general price of fuel. But to just that same extent, we fancy, the value of copper and copper properties would be appreciated.

WIRELESS TELEGRAPHY.

A paper recently communicated to the Paris Electrical Congress by Messrs. Blondel and Ferrié, gives a good general summary of the results which have hitherto been attained in telegraphy by means of Hertzian waves. The authors give to Branly the credit of the coherer principle, to Lodge that of the coherer apparatus, and to Marconi that of the vertical wires or antennæ. The greatest distance at which Marconi has succeeded in establishing communication they state as 136 km, or, roughly, 80 miles.

The theory of the operation of wireless telegraphy offered is very meagre and confessedly inadequate. That given by Heaviside, while itself defective, is more satisfactory. A number of practical facts are, however, added, which more than compensate for deficient theory. A curious difference exists between the law of distance for transmission of electromagnetic waves as dependent upon height. In the case of those waves which excite the retina, and which we call optical waves, we know that the distance at which we can observe remote objects at our own elevation increases as the square root of the elevation. Consequently to see twice as far (assuming an unimpeded view of the horizon) we must have four times the elevation. In the case of Hertzian waves, however, the distance to which effective transmission may be carried between antennæ of equal elevations increases with the square of the elevation. Four times the height gives sixteen times as great a range. This rule has no doubt its limitations, and assumes, among other things, equally good apparatus and equally good earth. But it is at least fortunate that the distance varies as the square and not as the square root of the height. The coherer is far less limited in this respect than the telescope or the heliograph.

It is wonderful how much seems to depend upon the earth in Hertzian-wave telegraphy. It is common belief that the earth has little or nothing to do with the matter, and that the air or upper world of ether is all important. On the other hand, however, it is now recognized that transmission can be carried considerably further over the ocean than over the land, and it is believed that the difference is due to the higher conductivity of sea water. It is even stated that on land the dryness or dampness of the soil noticeably influences the transmission, and apparently from the same cause.

It is further stated that Hertzian-wave telegraphy has been a failure in South Africa during the recent war, owing to the general prevalence of bad earth. Not only is good earth in the telegraphic

sense difficult to secure, but the long desert plains are most unfavorable to the transmission of electric waves. What is ideally needed for their transmission is a highly conducting level surface over which the waves may run without absorption, being continually reflected. In the absence of such an electric mirror, the waves tumble into the earth and become absorbed, as well as dispersed.

All these conditions seem to point to the ocean as the future scene of utilization of Hertzian-wave telegraphy. On land we can ordinarily hang or bury our wires and be content. At sea we are unable to maintain metallic communication, and where the ocean begins the opportunity of the wireless telegraph begins also. It is to be hoped that the day may not be far distant when the lighthouses along our coasts will also be Hertzian-wave houses and issue signals day and night to the shipping within 50 miles radius. The steamer's mast will then have two functions left, one to hold up flags and the other to hold the antenna.

THE PROGRESS OF ELECTRIC LAMPS.

This is the theme of one of the most important papers read at the recent Paris Congress, a careful and acute study by M. Blondel of the present state of the apparatus of utilization in electric lighting. The distinguished author has a profound knowledge at first hand of this branch of the art, and his thorough résumé is a more important contribution to electrical engineering than are most experimental researches. And it is the more valuable and worthy of study for the reason that the bald facts are set forth judicially, unextenuated by commercial euphemisms, undistorted by personal bias.

The topics which seem to us of special importance in M. Blondel's paper are four—namely, enclosed arcs, alternating arcs, arc light carbons, and special incandescents of high economy. While electrical engineering in this country is in many respects far in advance of Continental practice, in others it may have something to learn, and while some of M. Blondel's comments are a bit distasteful, we shall quote him freely, leaving to the engineering profession its own defense against any statements which it conceives to be hypercritical.

As regards enclosed continuous currents arcs, which, by the way, he credits with longer burning capacity than is familiar to most of those who use them, M. Blondel sums up the case as follows: "The advantages of enclosed arcs are the independence of the lights, their adaptation to connection simply across 110-volt mains, or two in series upon 220 volts, the extreme simplicity of the mechanism, the employment of carbons of mediocre quality, the greatly reduced consumption of carbon, the reduction of labor. Their inconveniences, on the contrary, are the blue tint of the light, variations of brightness which can be reduced only by the use of a diffusing inner globe, which absorbs a part of the light, the clouding of that globe by a deposit during the period of burning, and the mediocre luminous efficiency when large carbons are used." As to the distribution of the light of which the maximum is about 15 degs. or 20 degs. below the horizon instead of 45 degs., this can be considered an advantage or an inconvenience according as one is dealing with lighting in the open or in interiors. M. Blondel goes on to point out that in lighting off constant potential mains the luminous efficiency for equal energy of the enclosed arc is one-half to two-thirds that of a pair of open arcs in series and suitably shaded, while as regards such lamps taking as little as 4.5 amperes, MM. Gérard and De Bast had found them taking from 2.9 to 3.7 watts per spherical candle-power, a result which might be improved by using smaller carbons. This, of course, means a higher current density and somewhat lessened life. Obviously in series lighting the net energy per candle-power would be reduced to about .7 of the figures indicated above.

But in dealing with alternating arcs M. Blondel is drastically frank, quoting the following formula for the hemispherical intensity of the alternating arc, with reflector, in Hefner units: $L = 1.4\ W - 102$, i. e., a 400-watt arc should give 458 Hefner units, almost exactly 400 standard candles. This is about .6 the efficiency found by Blondel himself for an open continuous current arc. For the enclosed alternating arc the results quoted are 3 to 4.3 watts per Hefner unit. On account, however, of the rather unsatisfactory methods for rating arcs, which are well known to fail materially in giving a proper measure of the real efficacy of the lamps for practical purposes such as street lighting, M. Blondel goes on record as in favor of rating arcs somewhat as is done in the lighting contracts of the city of Paris, by the total luminous flux below the horizon. With all the varieties of arc now in use, we may venture the suggestion that since illumination is the thing desired and paid for in city lighting contracts, the fairest method would be to call in the specifications for a certain minimum intensity of illumination at a specified distance from the arc, and let the lighting companies hunt their own methods.

In the matter of carbons, there is little chance for disguising the fact that in the production of very high grade carbons both cored and solid, the Continental makers are ahead of the game. As M. Blondel clearly shows, much of the progress abroad is in the direction of constant potential arcs for use two or even three in series upon a 110-volt circuit, and for such work the best carbons are none too good. For alternating arcs, too, particularly good carbons are needed, and very large quantities of these are imported into this country from the Continental factories. The French prices quoted by M. Blondel for fine carbons such as he has described are enough to make the American station manager grow green with envy—$10 to $14 per thousand for 12-in. half-inch diameter carbons is the price in Uncle Sam's money. By way of rubbing it in, M. Blondel remarks that we make "for American consumption only inferior qualities of squirted or moulded carbons"! Let our good Yankee makers arise and say things, and also take steps to drive the foreigners out on their merits.

Coming now to incandescent lamps, M. Blondel gives our station men another bad quarter of a hour by noting that at the present time a good 16-cp 110-volt lamp can can be bought in France for from 10 to 12 cents! American makers would hardly agree as to their quality, perhaps, but it would be a very good thing for some institution to import a barrel or so and put up a little competitive test, inquiring incidentally into the foreign cost of manufacturing, for in these United States there are few lamps so bad that they would be unloaded at such rates. Foreign makers, M. Blondel says, "announce excellent results (in economy), but they are generally obtained on batteries of accumulators," 3.5 watts per candle being standard on large commercial circuits. As regards lamps of 220 volts or thereabouts, M. Blondel bluntly puts the case as follows: "The lamps at 220 volts are inferior in life and efficiency to lamps of the same candle-power at 110 volts; for example, instead of 50 to 55 watts, a 16-cp lamp at 220 volts takes 65 to 80 watts." He regards lamps having filaments mixed or coated with refractory substances as of improved stability and dubious value, although they have experimentally been worked down to 2 or even 1.5 watts per candle. Of the Nernst lamps thus far produced, he states that while they have been driven at an efficiency of 1 to 1.75 watts per candle, the practical durability of the filament has not yet been established, and fears that it may prove hypersensitive to variations of voltage. "If they are all that they promise," says M. Blondel, nevertheless, "they will have a most brilliant future and will annul the difference in cost of lighting by gas and electricity." And, moreover, it is pointed out that Nernst lamps can readily be made for 220 volts or more. If so, they will have a doubly warm welcome.

The Lighting of San Juan, Porto Rico.

In our last issue attention was prominently called to the electric lighting situation in San Juan, Porto Rico, where an attack of suspicious and even vicious character has been made on an enterprising American company putting in a new street lighting and trolley system there. To support the attack, alleged interviews with two editors of two New York electrical journals were published in San Juan, roundly damning the alternating current and aerial circuits. We referred to the dubious nature of these interviews and ventured to hope that we might elicit a denial that would counteract the intended injury to the new company in San Juan. Mr. W. L. Hedenberg, editor of *Electricity*, whom the local Porto Rican newspaper had named, now comes forward in his latest issue and, as we anticipated, contradicts the interview alleged to have been had with himself as follows: "I beg to say right here that the statements credited to me are false from beginning to end." This emphatic refutation should give a quietus to the clumsy conspiracy in our West Indian annex against American enterprise and modern electrical apparatus.

The Galveston Calamity.

Further details of the great storm and tidal wave at Galveston show that the first reports noted in these pages last week were not an exaggeration. It now appears that over 4000 names of the dead have already been compiled, and that the loss of property may easily reach $15,000,000 to $20,000,000. Among those in the electrical field known to have been lost are Mr. W. Pilford, of the Mexican Cable Company, and four children; the wife and three children of S. A. Nolley, an operator; the wife, two sisters and two children of L. J. Lackey, an operator, and the whole family of Chief Operator Johnston, of the Postal Telegraph Company. Other bereavements are also said to have occurred. Mr. J. C. Smith, manager for the Western Union, lost his house, and barely saved his family; indeed, the loss of property was universal. With characteristic generosity, Mr. Chas. McLaughlin, of the firm of J. H. Bunnell & Co., sent $100 at once for the telegraphers on the news of the disaster, just as he did on several similar occasions at Galveston, Charleston, Cincinnati, etc., and we note the names of other electrical contributors in the lists of the various relief funds.

The telegraph lines with Galveston are now working fairly well, but are overburdened with business. The local lighting and street railway companies are rapidly pulling themselves out of the wreck. The district from Twentieth to Twenty-seventh Street and from the bay to Broadway now has all its street lights going. The Brush Electric Company's plant comprises Brush arcs and Westinghouse alternating incandescents, and Mr. J. R. Cox is manager and purchasing agent. The city of Galveston also has a municipal plant of Western Electric arcs and incandescents, and Mr. D. Hall is superintendent. The Galveston City Railroad Company, which has been a great sufferer by the disaster, has a large arc and incandescent plant of General Electric and Westinghouse make. Its street railway system, of the same brands, comprised 64 motor cars and 12 trailers, and there are 39 miles of track. The work of clearing the lines of the system has been enormous. The road has been in the hands of Mr. R. B. Baer, as receiver and purchasing agent.

Motor Vehicle Licenses.

An important decision was given in New York City last week by Magistrate Olmsted in the Jefferson Market Court, which affects the owners and operators of automobiles and other motor vehicles. He decided that an operator of one of these vehicles having less than ten horse-power need not be a licensed engineer. This will affect the well-to-do drivers who have been unable to operate their own vehicles in this city, owing to the fact that they were not licensed engineers and did not belong to a labor union.

The case that caused the decision was that of Stanley D. Atkinson, who is employed by John Wanamaker to sell automobiles and instruct the purchasers in the operation of them. He was at Sixty-third Street and Fifth Avenue on Aug. 30 when he was arrested by bicycle policeman G. H. Conneally, who is detailed to look out for offenders of Section 342 of the city charter, which provides that no person except a licensed engineer can use a steam boiler carrying over ten pounds of steam and ten horse-power. Atkinson, it was charged by the policeman, had an automobile carrying 220 pounds of steam. Atkinson admitted that he had, but said that the vehicle had only six and one-half horse-power. Magistrate Olmsted then discharged him, deciding that the vehicle did not require a licensed engineer.

It is stated this week that Mr. Olmsted's decision is to be disregarded by the Police Department. The decision is the first of the kind; every other arrest resulted in a fine, usually of $25. Sergeant Mangin, of the Boiler Inspection Bureau, says that Sections 342-5 of the charter clearly imposed upon the police the duty of exacting compliance with this requirement, and that, if anything, a closer watch would be kept hereafter to detect violations. There are nearly 300 automobiles now in use in this city, almost all the engineers' licenses having been issued this year. The Department has no supervision over those operated by gasoline or electricity. Machines run by the former are looked after by the Fire Department; electrical vehicles, owing to their simplicity, may be operated by anybody. It is not enough to have an engineer's license to operate a steam automobile; the operator is liable to arrest, even if he has that, if he has neglected to have the boiler officially tested. There is no real hardship, the police say, in these requirements; any intelligent man can quickly qualify for an engineer, and to remove the restrictions would be to endanger the public.

Importations of India Rubber.

More than a hundred million dollars' worth of india rubber has been imported into the United States during the past four years, and more than sixty million dollars' worth in the last two years. A decade ago the annual importations of india rubber amounted to about $15,000,000; now they exceed $30,000,000, and are steadily increasing. Practically all of the importations of rubber come in crude form for use of manufacturers, who are constantly extending its application to various new lines of industry. Northern Brazil, Southern Mexico, the West Indies, Central Africa, India, the Straits Settlements and the Dutch East Indies supply this increasing important feature of our importations. Probably no single article has made a more rapid growth in its relations to manufactures, and, consequently, commerce, in the past few years than rubber.

The above statement is suggested by the receipt by the Treasury Bureau of Statistics of a publication detailing the systematic efforts being made for the cultivation of india rubber trees and plants in the British colonies, especially those of Central and South Africa. This, coupled with the well-known fact that our own Department of Agriculture has already begun experiments and inquiries in this line in the island territories of the United States, adds greatly to the interest in this question and to the possibility that the $30,000,000 a year which we are now sending out of the country for this product may be expended under the American flag and among American producers. The fact that Southern Mexico and Central America are natural producers of india rubber in considerable and increasing quantities, and that large quantities are produced in and exported from the islands and mainland immediately adjacent to the Philippines, suggests great possibilties in this line both in Cuba, Porto Rico and in the Hawaiian and Philippine Islands.

India rubber is not, as is generally supposed, the product of a single tree; but, on the contrary, is produced from a variety of trees and plants. Some of these flourish only in a moist soil and atmosphere, while others thrive on stony soil, provided they receive ample though intermittent rainfall; though in all cases a tropical or sub-tropical climate is requisite. Most of the india rubber of South and Central America and India is from trees, but in the islands of the Indian Archipelago the supply of rubber is chiefly from a gigantic creeper, which in five years' growth attains a length of 200 ft. and from 20 ins. to 30 ins. in circumference, and which yields annually from 50 lbs. to 60 lbs. of caoutchouc.

The following table shows the value of the importations of crude india rubber and gutta percha into the United States in each fiscal year from 1894 to 1900:

Fiscal Year.	Value.
1894	$15,162,333
1895	18,475,382
1896	16,781,533
1897	17,558,163
1898	25,545,391
1899	31,875,207
1900	31,555,483

The Electric Fountains at the Paris Exposition.

IN recent issues of this journal details and data, as well as numerous pictures, have been presented in regard to the general and special lighting of the Paris Exposition, more particularly that which relates to Electricity Building and the Champ de Mars, where all the great spectacular effects are appropriately concentrated. The chief and leading feature is, of course, the electric fountains, which for many reasons were latest in getting into operation, but which asserted their supreme attractiveness as soon as all the desired effects were fully obtained. Not only was it the intention to surpass, if possible, the notable electric fountains at previous world's fairs, but to secure new results in a novel way. The association of colored electric light with masses and sprays of moving water has been experimented with most successfully in past years, notably by Sir Francis Bolton in England in 1884, at the "Healtheries," and by Mr. Luther Stieringer at the Chicago Columbian Exposition in 1893; and the French, with whom the principles of the luminous fountain may be said to have originated with Prof. Colladon as far back as 1842, did not propose and could not afford to be left in a position of inferiority in this field during the present memorable year.

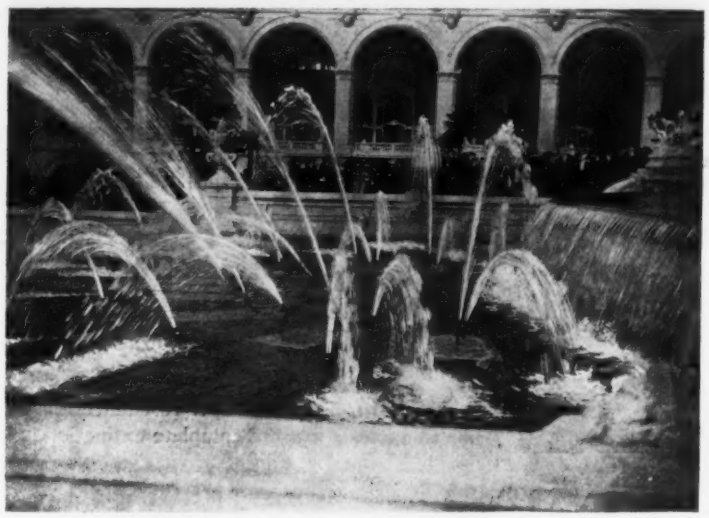


FIG. 1.—THE LOWER CASCADES AND LARGE BASIN FOUNTAINS.

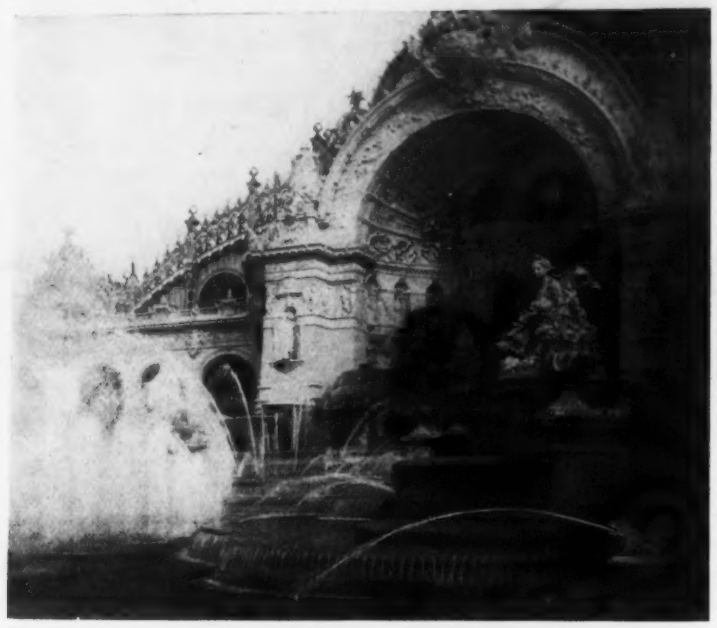


FIG. 2.—THE CHÂTEAU D'EAU AND UPPER CASCADES.

The success of the illuminated Trocadero fountain at Paris in 1889 was so great, that in order to get the best results this time and eclipse it, the authorities opened a competition which was entered by several French firms. The project of Vedovelli & Priestley won favor, and with the aid of their accomplished engineer, M. Cleiren, was carried out, as described and illustrated in this article. It may be said that the fundamental idea is not merely to light up sheets and masses of water, but to split up the water into as many drops and as fine a spray as possible. Moreover, there was not only the bed of the fountain to illuminate, and its jets and "wheatsheaves," but in this case a cascade streaming from a lofty height, namely, the cavernous niche at the crest of Electricity Building; and as a third consideration the lighting had to harmonize and synchronize with that of the special effects on the front of that palace, as described recently in these columns. Hence a careful combination of methods was not only desirable but absolutely essential, as indicated in Figs. 1, 2, 3 and 4.

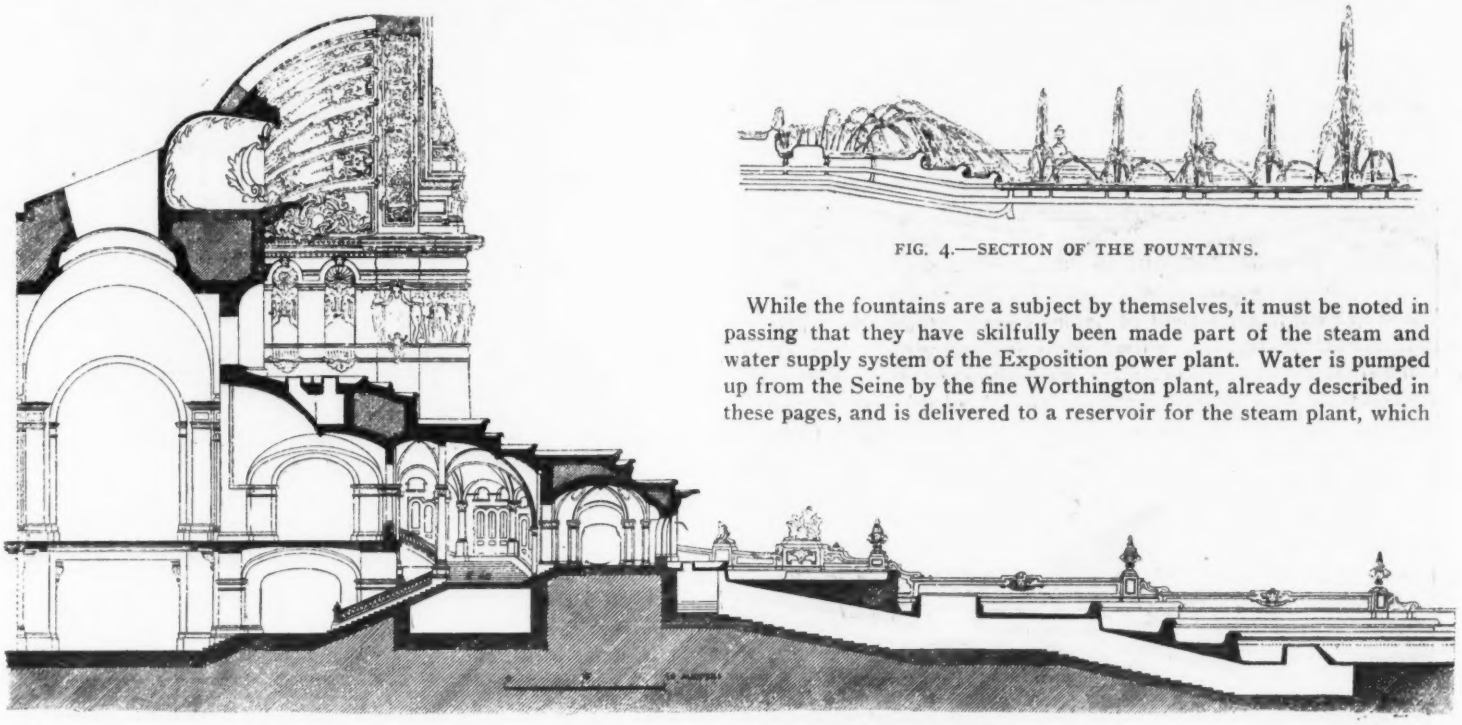


FIG. 3.—SECTIONAL ELEVATION, CHÂTEAU D'EAU.

FIG. 4.—SECTION OF THE FOUNTAINS.

While the fountains are a subject by themselves, it must be noted in passing that they have skilfully been made part of the steam and water supply system of the Exposition power plant. Water is pumped up from the Seine by the fine Worthington plant, already described in these pages, and is delivered to a reservoir for the steam plant, which requires over 50,000 gallons per hour for steam alone. This with the condensing water is used and returned through the medium of the lower stages of the fountains. The apparatus includes, however, separate motor-driven pumps for raising part of the water to the level at which it can burst out of the niche and constitute the streams that

cascade down the great front of the Château d'Eau. This waterfall is nearly 100 ft. high, and has a front of over 32 ft. As a matter of fact, water is thus delivered to the Water Palace under three different pressures for the work that it has to do.

All the lighting along the front of the Château d'Eau portal and on

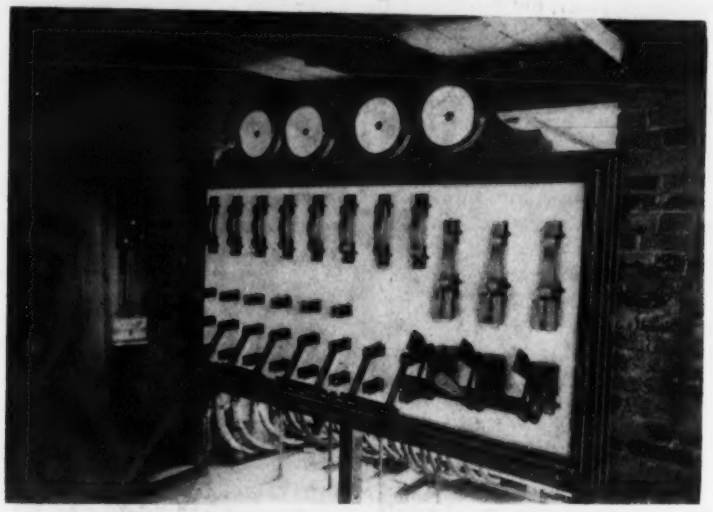


FIG. 5.—INCANDESCENT CIRCUIT SWITCHBOARD.

the terrace edges is done by incandescent lamps, of which, according to M. Cleiren, there are some 12,000. All the lighting of the larger masses of water rising vertically from the bed of the fountain is done by means of holophotes, the arc lamps being placed in spacious vaults under huge panes of thick plate glass, indicated in one of the perspective views, which was taken for this article at a time when the flow of water was not deep enough to conceal the floor. For this work some 96 arcs are used of different sizes. The water, is, as already stated, broken up as much as possible, as this insures the best illumination effects, and yields results that would be impossible with the masking obscurity of thick sheets. As a matter of fact, all the mechanism and lamps are concealed from the eye of the spectator on the Champ de Mars, and the central operating devices are concentrated in a large chamber underground, at the heart of the fountain. Four colors are used in all the effects, viz., red, white, blue and yellow, and these are so combined and graduated as to obtain a wide range of prismatic hues.

Beginning with the niche which may be said to form the apex of the vast hemispherical cavity or grotto, the water arrives there in three tubes bent into circles, and flows out in numberless jets through

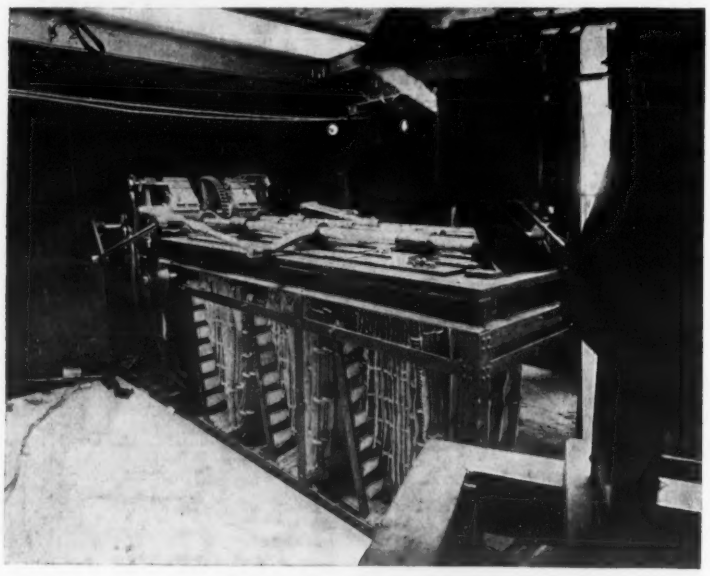


FIG. 6.—RESISTANCES FOR INCANDESCENT CIRCUITS.

perforations, spreading and bubbling in this manner over the incandescent lamps fitted to the tubes. The upper tubes nest into the lower ones so as to be shut down out of sight when the water is not playing. Within the hollows made by the carvings or mouldings of the arch

other lamps are placed, with elliptical mirrors behind them. The source of light is placed in one focus. The rays emitted from this source and reflected from the mirror are collected again in the second focus and go out through the narrow orifices in an intense beam seen across the spray. Incandescent lamps are also carried at the lip of each basin, so connected in circuits that they may be said to form 16

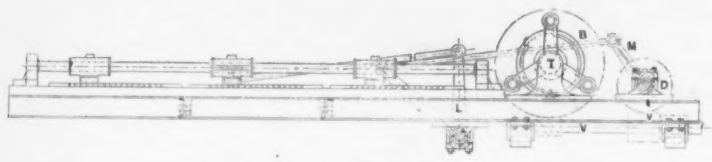


FIG. 7.—OPERATION OF RESISTANCES.

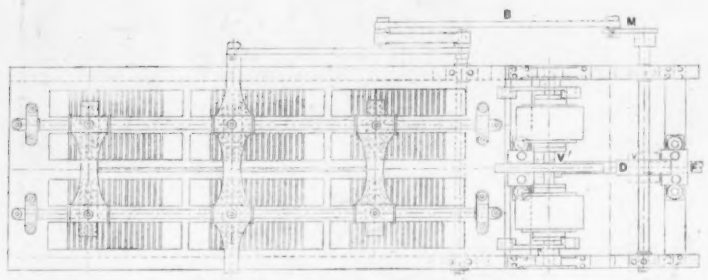
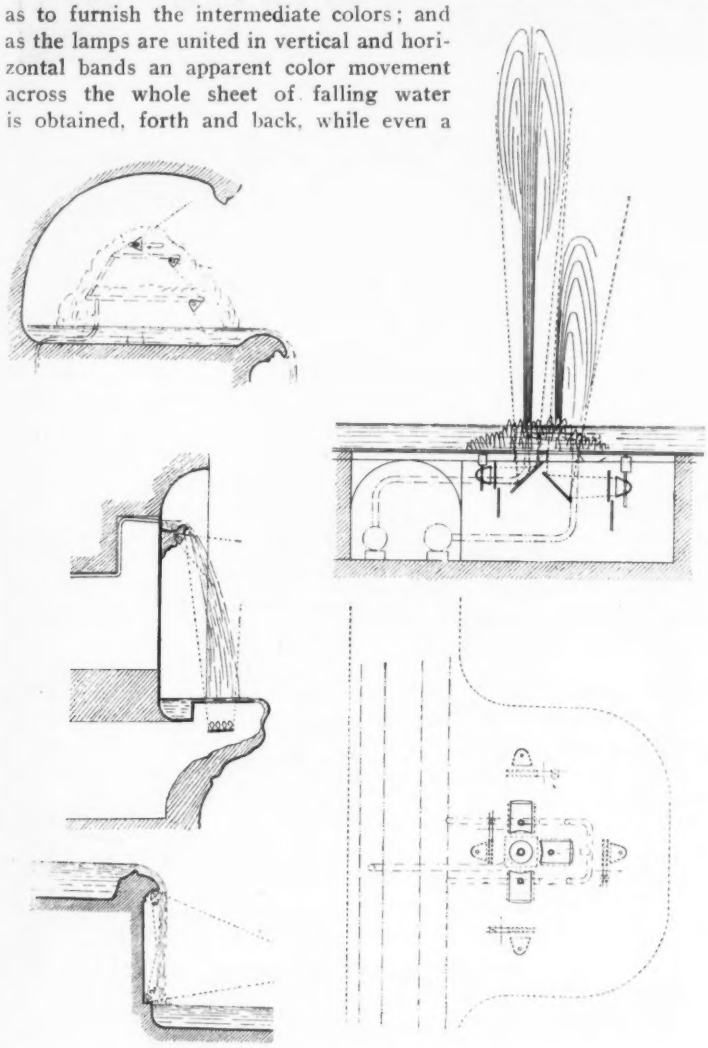


FIG. 8.—PLAN OF RESISTANCES.

banks vertically and 16 banks horizontally. Proper resistances allow the change from one color to another without complete extinction, so as to furnish the intermediate colors; and as the lamps are united in vertical and horizontal bands an apparent color movement across the whole sheet of falling water is obtained, forth and back, while even a

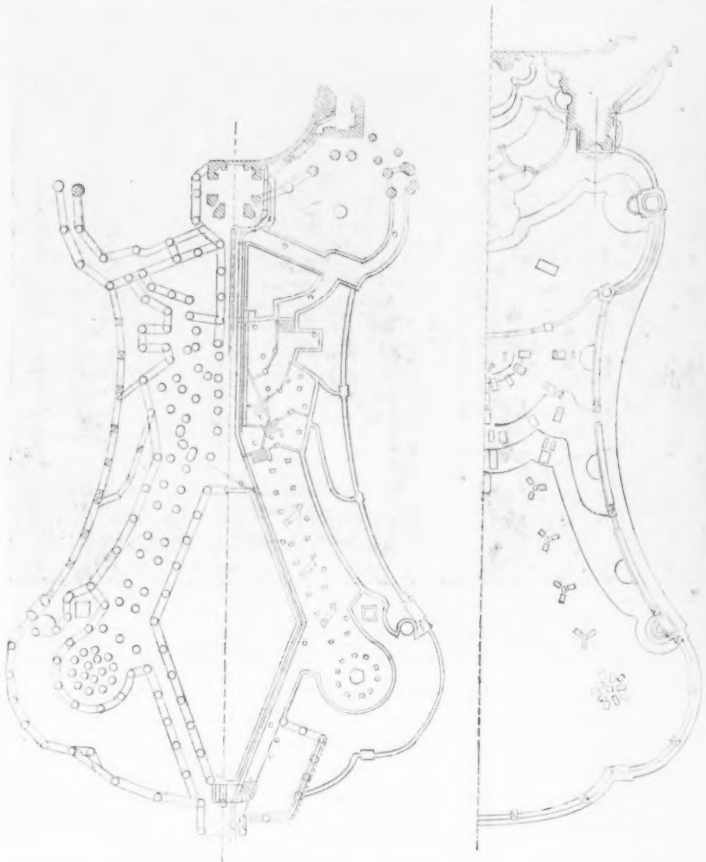


FIGS. 9, 10 AND 11.—INCANDESCENT NICHE AND CASCADE LIGHTING.

FIGS. 14 AND 15.—VERTICAL JET ARC LIGHTING.

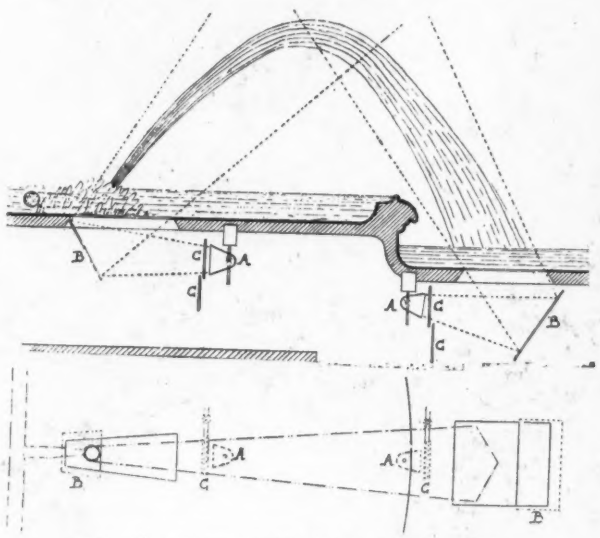
rotational effect is available by combining the two motions; and the colors can be made to chase each other up the front of the sheet as though the stream were seeking its higher source despite all of the laws of gravitation. In order to divide up these streams and get every

drop colored, the rims of the basins are provided with combs of iron, and between the teeth small plaques of glass are inserted. The larger cascades are in reality double, and to secure this the basin rims are double, so that while a greater thickness and volume of water is suggested, in reality a more intense luminous effect is secured by thinning the sheet. If the fall is a long one, additional rows of lamps are placed behind it. The incandescent lamps are held into the taut



FIGS. 12 AND 13.—PLAN OF FOUNTAIN CONSTRUCTION AND LOCATION OF ARCS ON ONE SIDE.

circuit wires by spring clips so that they can be readily renewed, and they are set in front of reflectors. They are also rendered invisible by painting the outward-facing side of the globes in such a way that the light which passes through the front of the bulb or globe shall be equal to that which comes from the reflector placed behind. Under



FIGS 16 AND 17.—LIGHTING PARABOLIC JETS.
A, Arc. G, Color Screen. B, Mirror.

these conditions, a surface provided with these lamps appears to the distant eye to be uniformly illuminated without an indication of the specific illuminating points along it. (Figs. 9, 10 and 11.)

The method of handling these incandescent circuits is shown in in the accompanying cuts, Figs. 6, 7 and 8. The currents coming from the incandescent switchboard go either direct to the circuits of the lamps or pass first through a special rheostat which has the object to produce light effects which Messrs. Vedovelli & Priestley call "isochrome"; i. e., one color changes into another color, by passing through all intermediate shades of color.

This rheostat is shown in detail in Figs. 7 and 8. It is driven by a motor placed at the end of the axle *F*. This axle is provided with an endless screw *V*, which acts upon a wheel *D*, and thus operates the

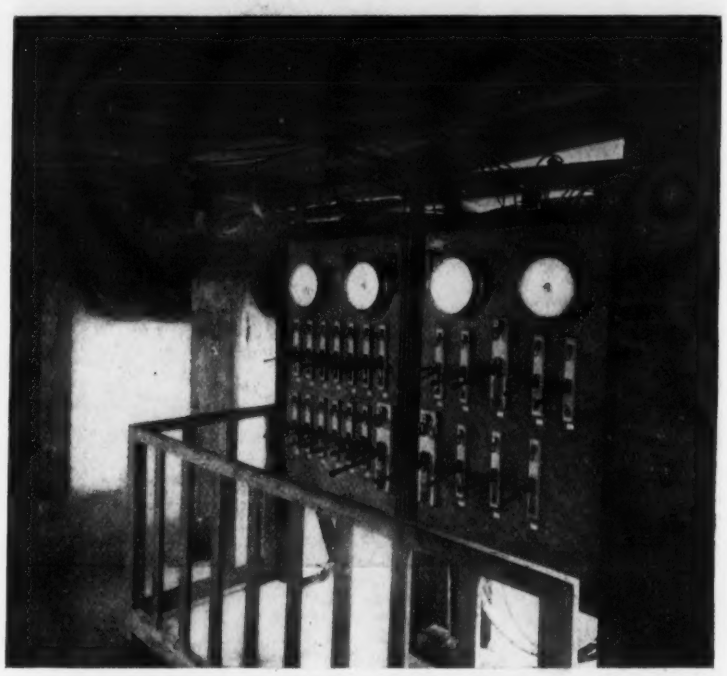


FIG. 18.—ARC LIGHTING SWITCHBOARD.

crank *M* and the rod *B*, so that the rotary movement of the motor axle is changed into an alternating rectilinear motion, by which the resistances of the rheostat are gradually switched in and out. A second endless screw *V'* turns with a slower speed a drum, in order to introduce a new color at the moment when the whole resistance is inserted, so that the new color has a very small intensity, while the old color has the maximum intensity. Gradually the intensity of the

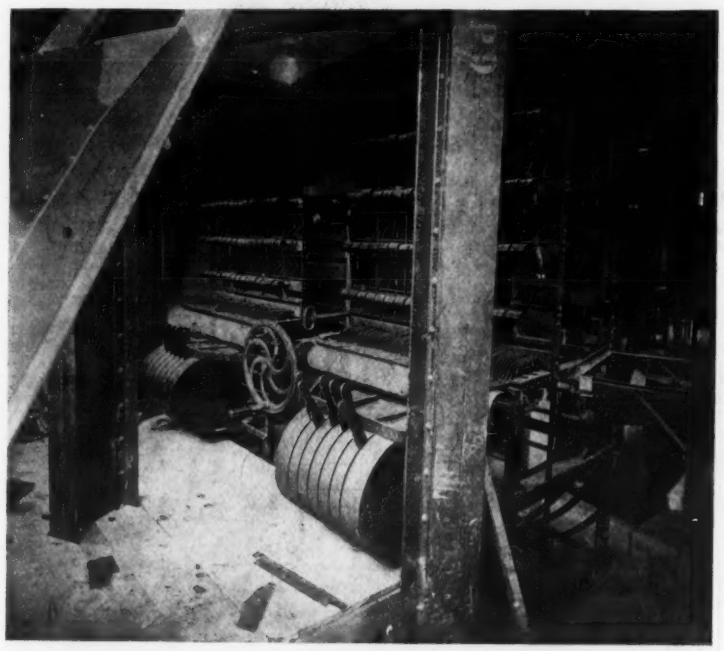


FIG. 19.—KEYBOARD AND CONTROLLING DRUMS, ARC CIRCUITS.

old color decreases, while that of the new color increases, so that all intermediate shades of color are obtained. The resistance is divided up into three sections to preserve the contacts.

The power used for the entire installation is 450 kilowatts, of which 300 kilowatts is taken by the incandescent lamps, it being understood that they are never all on at once. The three-wire system is used with

500 volts between the outers. The incandescent lamps are from 30 to 50 candle-power and are made to be run at 220 volts. The pumping station, which is also operated chiefly for their benefit, comprises two tramway motors driving Dumont pumps, each furnishing about 50 gallons per second. The hydraulic part of the installation was made under the direction of Perignon and Vinet.

FIG. 20.—MERCURY CUPS AND CABLES, ARC LIGHTING.

Coming now to the arc lighting, we find it to consist of that done vertically and that which is done parabolically. There are all told 96 arcs of 10, 12, 15, 25 and 75 amperes, with reflecting mirrors of glass or nickeled zinc for the lesser intensities and of brass covered with mercury for the strong intensities. The parabolic jets are illuminated from both ends. That is, one beam of light is turned on them at the point where they start upward, while another beam is projected on the descending stream from the point where it falls. This is illustrated in Figs. 16 and 17. As the points where the water will fall in the basin varies with volume, direction of wind, etc., the sheets of plate glass above the lamps are of rather large dimensions. In order to prevent them from appearing to the spectator as mere ugly squares of illuminating surface, an artificial

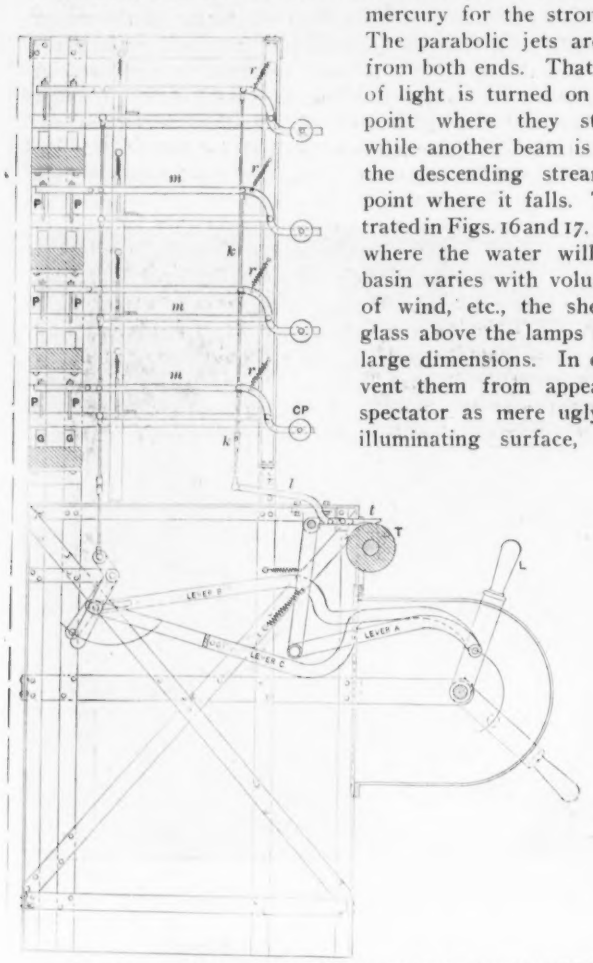


FIG. 21.—PLAN OF ARC LIGHTING CONTROL MECHANISM.

bubbling and spraying is produced by means of perforated lead tubes around each group of holophotes, so that the glass is quite disguised. The construction of the lowest basin and the disposition of the lights in it is indicated in Figs. 12 and 13.

In this area, no fewer than 54 arcs are placed, in two parallel rows of four fours and one eleven, the bunches of eleven being at the curve in the basin nearest the spectators on the Champ de Mars, and consisting of ten lamps of 25 amperes and a centre lamp of 75 amperes. The lamps are run five, four or three in series and take 100 kilowatts. Figs. 22 and 23 give an excellent idea of the method of placing the lamps in the underground galleries and of using the reflectors. It will be observed that the lamps are not burned with horizontal carbons, but with vertical, the former method being considered unsatisfactory in operation and less productive of good results.

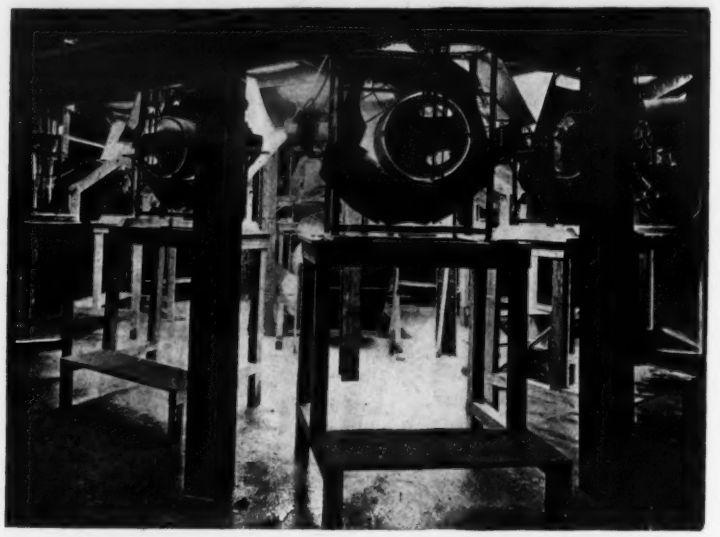


FIG. 22.—GROUP OF ELEVEN ARC LIGHTING HOLOPHOTES.

The current for the arc lamps, coming from the general direct current switchboard, is conveyed to a simple switchboard, Fig. 18, composed of circuit breakers and meters, etc., either for the lighting or for the extinction of the lamps. Other circuits convey the current to the solenoids by which the color disks are operated. All these circuits are connected to an apparatus, shown in Figs. 19, 20 and 21. Above cups with mercury are placed contact pins at the end of levers; by means of a mechanism, absolutely identical with that of a mechanical piano, the currents are closed or interrupted. The drum T is driven by a motor; on the surface of the drum screw-heads are placed at proper intervals, which raise the keys t and act in this way upon the levers, m, which have at one end the contact pins P and at the other end a counter-poise C P.

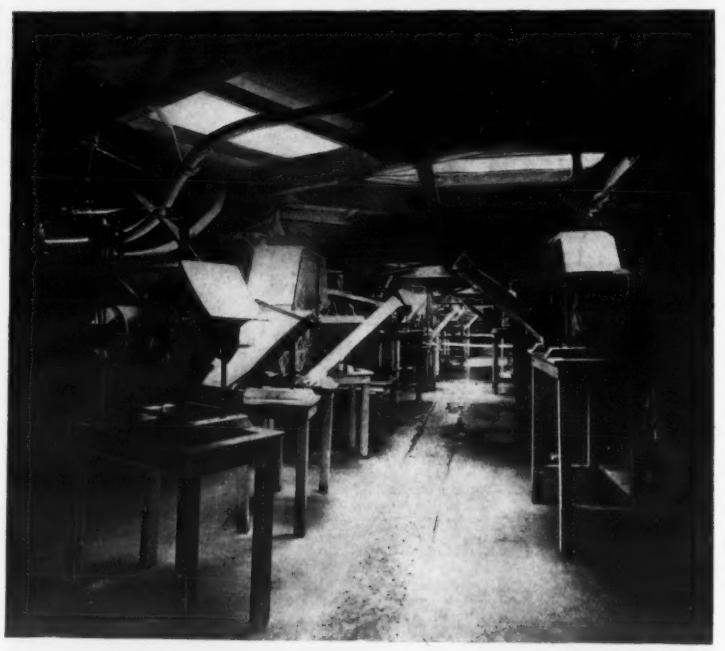


FIG. 23.—THE LONG GALLERY OF FOUR ARC GROUPS.

At the base of the apparatus there are some general levers, A B C, operated by the handles L; (1) a lever for lighting or extinguishing all the colors at once; (2) a lever for lighting a single color, there

being three such levers; (3) a level *A* for raising all keys *t*, in order to change the cylinder *T*.

The apparatus just described accomplishes the distribution of the current which sets into operation the apparatus of the color disks at the lamps. There is a stout supporting wooden frame placed between the arc lights and the reflecting mirror. The color disks, red

FIG. 24.—ARC LAMP, COLOR SCREENS, SOLENOIDS, MIRROR AND STAND.

blue and yellow, consist of two vertical halves, separated and balanced. They are operated and swung together in front of the arc by an electromagnetic device by the solenoids shown. The white color is obtained with all disks open, and the black color or darkness with all disks closed. As it is impossible to light at once suddenly a hundred arcs, first all disks are closed, then the arc lamp circuits are switched in, the necessary adjustments are made, and finally the automatic keyboard apparatus shown is started, with a certain drum which corresponds to a certain desired change or play of color, as a drum in a mechanical piano corresponds to a certain piece of music. When this show is finished, the drum is replaced by another drum, and so on. Not only are very pleasing effects thus obtained, but the light can be

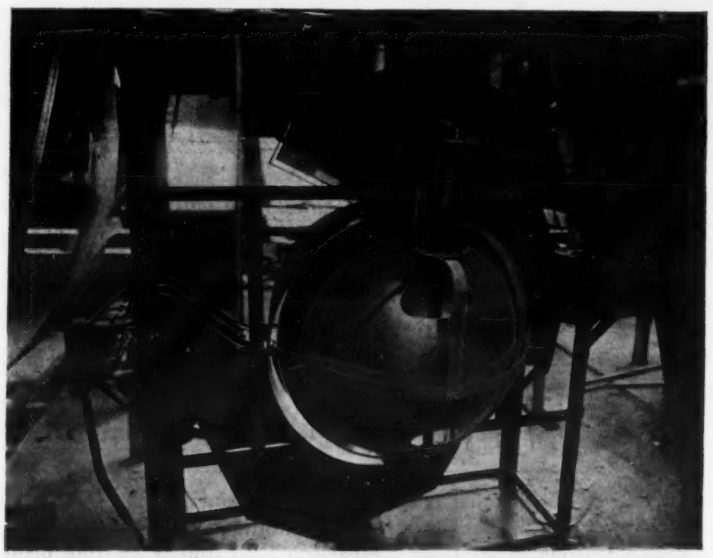


FIG. 25.—REAR OF LAMP, LOOKING INTO MIRROR AND SHOWING SUSPENSION.

made to revolve around the outer edge circle one way and around the inner circle in a reverse way. If while this effect is obtained, the other rotational and translational effects with the incandescents are given, the effect seen by the eye of the observer is not only beautiful but bewildering, especially as there is the further play of electric colors on the front of Electricity Building.

Hitherto the operation of electric fountains has been conducted with a good deal of privacy and even of secrecy. At Paris, however, the whole thing is thrown open to the public, and for a franc or two one can wander around the long, solid galleries and see how the lights are used and the changes of color are effected. In the room under the cascades, containing the automatic arc keyboard, the incandescent resistances, etc., the visitors are enabled also to secure an image of the spectacle going on above their heads, by means of special mirrors and a powerful lens, the image being thrown upon a conveniently placed screen. This serves at the same time as an excellent guide to the attendant for the testing of the regular operation of the whole apparatus. Very little labor around the lamps is required, beyond that of trimming and patrol, due to the multiplicity of apparatus and the employment of some 3000 circuit wires.

The Chicago Board of Trade Telegraph Service.

At a special meeting of the Chicago Board of Trade on Sept. 14 a resolution authorizing the president and secretary to execute contracts with the Exchange Telegraph Company was adopted. The first of these contracts provides for the completion of a comprehensive telegraph system connecting the important exchange centres on or before Dec. 31, 1904, upon completion of which line the Exchange Telegraph Company is to have the exclusive telegraph space in the Exchange Hall and Board of Trade Building in Chicago. The second contract covers the dissemination of the Board of Trade quotations

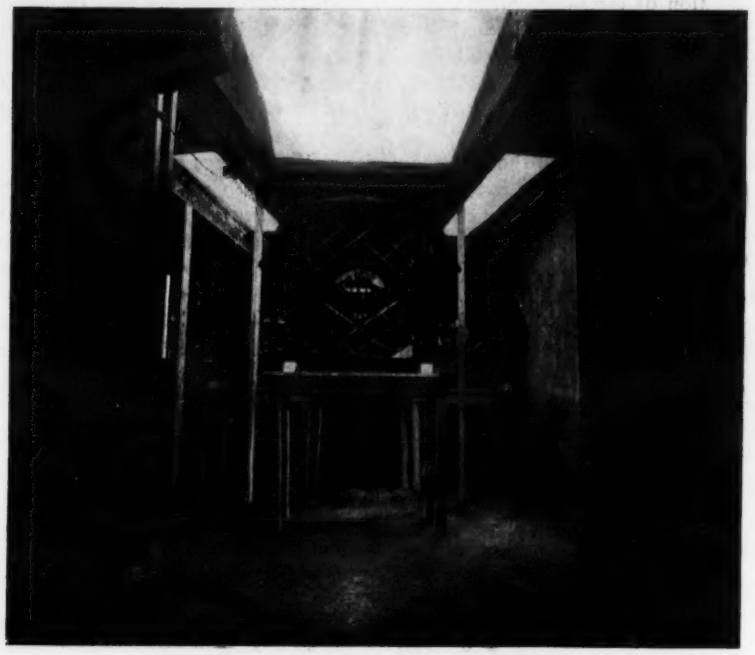


FIG. 26.—ONE OF THE LARGE ARCS FOR LIGHTING PARABOLIC JET.

throughout the territory covered by the lines of the Exchange Telegraph Company, with the exception of the city of Chicago.

The contracts will be signed at once, but it is not the intention that the Western Union and Postal Telegraph Companies shall be ousted from the Board of Trade building immediately.

General Manager Crawford, of the Exchange Telegraph Company, says on this subject: "The Exchange Telegraph Company will begin work as soon as the contracts are signed, and will disseminate Board of Trade quotations to such points as it reaches in the process of completing the system. The entire system will comprehend about 5000 miles of telegraph line, will cost, complete, between $5,000,000 and $7,500,000, and will extend to the following cities: Peoria, Indianapolis, St. Louis, Kansas City, Omaha, Sioux City, Minneapolis, Duluth, Milwaukee, Toledo, Cincinnati, Detroit, Philadelphia, Baltimore, Boston, Buffalo and New York. The conclusion of the matter is the result of the bucket-shop trouble. The officers of the Exchange Telegraph Company have not been chosen permanently, but will be at once. It is the intention that as much of the stock of the company as possible shall be sold to members of the Board of Trade in the determination that a close, indissoluble alliance shall exist between the telegraph system and the board, so that it will be impossible for quotations to be obtained for illicit uses."

The Steam-Driven Isolated Lighting Plant—Does it Pay?

By W. D. Ennis.

THE only apology for the existence of a central station supplying electric current for power and light consumers in the public market must be based on two principles: First, that the greater the amount of power machinery combined into single units, the less proportionate space is required for operation; second, that in large, centralized units a higher degree of efficiency in both materials and labor is possible than with small, disorganized private plants.

The first principle is introduced not as one that is new, but as one that is often overlooked. Floor space and head room, if not indeed a separate building, must be provided even for the smallest plant. In some cases this is an all-important factor, while in a large hotel with ample cellar room, for instance, it may be quite negligible. Where land and buildings must be acquired, or existing buildings altered, in order to accommodate a generating set with its high-pressure boiler and attachments, this item should, of course, be charged in with the other first costs in estimating on the advisability of installing a private plant.

As far as actual floor space is concerned, its value, considered as a part of the equipment incidental to a private lighting plant in an existing building, bears no relation to the actual price of real estate. The question is not one of the money-value of the land, but rather one of the space available under actual conditions. That is, the proprietor or lessee of the building must ask himself whether that portion of the basement which it is proposed to utilize is not, or could not be, applied to some better purpose; whether the space might not give larger returns as a billiard or barroom than as an electric station. In the case of a new building, the computation is more simple, and it is easy to estimate what it will cost to provide properly for generating machinery.

The second of the principles given above brings up the question of the probability of competing successfully with the highly organized central station. Some engineers have laid down the dogma that when a certain power capacity is reached, usually set at about 10,000 horse-power, there is no further gain in efficiency by concentration. In other words, according to this theory, a 10,000-hp plant will develop as many watt-hours per pound of coal burned as a 100,000-hp plant. It does not matter, for the purpose of this article, whether or not the statement given is strictly true. What is of consequence, however, is the fact that there are certain ranges of capacity within which under average conditions, the efficiency remains approximately constant. That is to say, for units of from 10 kilowatts to 100 kilowatts in size, we are practically restricted to the use of simple automatic engines, using upward from 33 lbs. of steam per indicated horse-power per hour on a variable load. Again, from 100 kilowatts to 500 kilowatts, say, we have the option between a high-grade, simple condensing engine and cross or tandem-compounds, using in connection with the feed-water heating and condensing apparatus introduced at this stage, from 18 to 28 lbs. of steam under the same conditions of load. From 200 kilowatts upward, it is possible to operate jet condensers with economy; and, as the 500-mark is neared, to realize an efficiency of perhaps 16 lbs. of steam with a fair load factor. Generalizing, we might say that between 10 and 100 kilowatts, 100 and 500 kilowatts, the efficiencies remain constant. Above this point, gains in efficiency are made rather by the introduction of the executive human element and by the increasing facility for adapting the material at hand to the work that is to be done. It requires a good man to run a 100-hp engine. It does not require 10 men to run an engine of 1000 horse-power.

The difference in economy between any two adjacent classes of those above described, when estimated on a comparatively small total output, is quite insignificant; and it is easy to comprehend that a man using from 10 to 100 kilowatts might be able to generate it himself more cheaply than he could buy it from a central station of from 100 to 500-kw capacity, when the line losses and maintenance and the profits of the business are taken into account. So, also, the consumer of 150 kilowatts could probably underbid the central station of 750 kilowatts. Unfortunately for the simplicity of the argument, however, the consumer and the central station are not ordinarily in adjoining classes. It is this fact that gives rise to discussion over the matter, and that makes it possible, according to the circumstances of the case, to decide competently whether or not a private plant will pay.

There must be a balance struck between the price charged by the central station for a year's supply of light, and the annual operating and maintenance costs and fixed charges of a plant capable of carrying the maximum load. The usual method of doing this has been to fix the size of plant required and then to calculate from the probable range and fluctuation of the load, the average annual expense. This is compared with the bills of the electric light company for a year's supply, and a balance shown in favor of one or the other of the totals. It seems more logical, inasmuch as central-station supply is the usual order of things, to consider first the annual cost under that condition; then estimate the size of plant required, fix upon a conservative efficiency as probable, and from the latter estimate the annual operating cost. Deducting from the annual cost of public supply this latter figure, we have a remainder from which the possible expenditure for equipment may be calculated. This we will endeavor to do.

The market price of electric current varies almost indefinitely, according to location, size of bill, promptness of payment and various other factors. A reasonable latitude of variation for the cases within the scope of this article is from 5 to 20 cents per kilowatt-hour. The load factor, or ratio of average consumption to maximum consumption, is, of course, variable, according to the class of service. The writer has for the past two years been collecting approximate data on this subject, and has obtained .29 as the average of 11 daily load factors, 5 of which were for office buildings, 2 for hotels, 3 for theatres, and 1 for a municipal building. The annual load factor would probably be about .7 of this, or .20, which is the load factor assumed in the following calculations.

If we know the amount of the annual bill and the rate charged for current, the quotient of these two will give the yearly consumption of current. Dividing the result by 300 will give a close approximation to the daily consumption. If we assume that light is used for 20 hours of the 24, the average load in kilowatts will then be equal to the annual output in kilowatt-hours, divided by 300 and by 20. The maximum load will be equal to the quotient of this result by the load factor. As there must be provision made for overloads, and as there will be considerable difference between the output as measured in light and the rated output of the machinery, it is fair to assume that the plant will be at least 50 per cent larger in capacity than the above calculations would give. These steps are shown for the various sizes of plant in the following table.

TABLE I.

Capacity of Plant Required, Amount of Annual Bill Being Known. Rate, 20 Cents per Kilowatt-Hour.

Amount of annual bill	$300	$400	$500	$800	$1000	$1500	$2000	$3000
Units used, kw-hours	1500	2000	2500	4000	5000	7500	10,000	15,000
Units per diem, kw-hours	5	6.67	8.33	13.33	16.67	25	33.3	50
Units per hour, kilowatts	.25	.33	.42	.67	.83	1.25	1.67	2.50
Capacity, load factor, 20, kw	1.25	1.65	2.1	3.35	4.15	6.25	8.35	12.50
Capacity, 50% margin, kw	2	2½	3	5	6	9	12	18

These capacities will increase when the rate charged for current is less, as the units used for a given annual bill will be greater. The capacity of plant for each grade of consumption and for various charging rates is shown in the following:

TABLE II.

Capacity of Plant Required, Amount of Annual Bill and Rate Charged Being Known.

Amount of annual bill		$300	$400	$500	$800	$1000	$1500	$2000	$3000
At 20c. per kw-hr	Capacity of Plant Required.	2	2½	3	5	6	9	12	18
At 15c. " "		2½	3	4	7	8	12	16	24
At 10c. " "		4	5	6	10	12	18	24	36
At 5c. " "		8	10	12	20	24	36	48	72

The probable annual operating cost of plants of the above sizes will vary according to the particular conditions, but can be estimated within reasonable limits by comparison with similar existing plants. Under varying loads, and working with an average load factor of .20, the boilers will evaporate at best from 4 to 7 lbs. of water per pound of coal. Under the same conditions, simple automatic engines for plants of these sizes will consume from 35 to 100 lbs. of steam per indicated horse-power per hour, and 80 lbs. is probably a fair figure. The mechanical efficiency of the engines will not be over 90 per cent, and may be as low as 75 per cent. On small loads it may be as small as .50. A liberal estimate would be to fix this at .75 for the all-day run. The generators may average up to 80 per cent efficiency. The

pounds of coal per kilowatt under these circumstances would then be equal to 80 ÷ 5½ ÷ .75 ÷ 80 × 1.34, or 32.32. Under more favorable conditions, especially with the larger sizes of apparatus, this figure will, of course, be less. For a 72-kw installation, with a good load factor, the boilers might evaporate 8 lbs. of water, the engines operate with 40 lbs., and the pounds of coal per kilowatt approximate 40 ÷ 8 ÷ .90 ÷ .90 × 1.34, or about 9. In estimating the operating costs, a graded range of efficiency is assumed between these two extreme figures. This, of course, assumes for the larger plants more favorable conditions than are ordinarily met with.

TABLE II.—B.

Assumed Efficiencies of Plants of Various Sizes.

Capacity of plant, kw..	2	2½	3	4	5	6	7	8	9	10	12	16	18	20	24	36	48	72
Lbs. coal, per kw.....32	31		30	29	28	27	26	25	24	22	20	18	16	14	12	10	9	9

The cost of water, if purchased from the public source of supply, as is usually the case in plants of this kind, will be from 5 per cent to 20 per cent of that of coal. Oil, waste and various small items will reach a total not less than a quarter of the coal bill. The labor charge for the smallest steam driven plant in the city would hardly be less than $400 annually, and will range from this figure to about $1,100 for a 20-hour daily run, excluding Sundays and holidays.

In the following tables of estimated operating costs, the annual output has been figured at 50 per cent over the output for the stated annual bill, for the reasons above given. The coal is estimated at $5 per ton, the water at 10 per cent of the coal, and "sundries" at 25 per cent. The labor item is graded from $400 to $1,100, according to the size of the plant. The heavy vertical lines represent the points at which the operating costs begin to be less than the price charged at the given rate. These appear to demonstrate that for the given conditions it does not pay to install a plant when the bill is less than $1,000 yearly, even when the rate is as high as 20 cents per kw-hour.

Glancing down the right-hand column, it may be noted that the total operating expense for a plant of 90,000 units annual output is only a little over twice that of a plant of 22,500 units total output; or that four times the light is obtained for twice the cost. This will be found to hold true in all of the columns, and shows strikingly the great advantage that the central station must always have—that is, that the total output can be increased without anything like a proportionate increase in the operating expense.

We have seen that in certain of the cases considered, the total operating expense may be less than the annual bill. It remains to be seen whether the difference between the two is great enough in any case to warrant the establishing of a private plant. These differences must be used to pay fixed charges, as follows: Taxes, insurance, interest, depreciation, and, in the case of a lessee, sinking fund. Taxes will average about 1½ per cent; insurance (increase on building and contents, at 20c., assuming the plant to be worth 8 per cent of the value of the former), 2½ per cent; interest 6 per cent; depreciation, 5 per cent; sinking fund (10-year lease), 10 per cent. Where the building is leased and a sinking fund provided, the interest charge will, of course, be 3 per cent, instead of 6 per cent. The depreciation charge being applicable to repairs in both cases, it will not be balanced by the sinking fund. The total fixed charge is then, for an owner, 15 per cent; for a lessee, 22 per cent. If, then, the differences between operating expense and annual bill, as calculated from Table III., are sufficient to pay 15 or 22 per cent, as the case may be, on the capital required for installing a plant, a private equipment will just pay expenses and no more. Taking the "differences" as equivalent to these percentages, we can calculate the justifiable expenditure in first cost of apparatus.

TABLE IV.

Probable Economy of Installing Private Plants.

Price of Current, per kw-hr.	20c.			15c.		10c.	
Amount of annual bill.....	$1500	$2000	$3000	$2000	$3000	$2000	$3000
Yearly operating expense....	$1388	$1538	$1815	$1790	$1865	$1865	$2244
Difference.....	$112	$462	$1185	$210	$1135	$135	$756
Capital expenditure, owner..	$747	$3080	$7810	$1400	$7570	$810	$5040
Cost of plant, at $100 per kw.	$900	$1200	$1800	$1600	$2400	$2400	$3600
Surplus capital, owner.....	—$153	$1880	$6010	—$200	$5170	—$1590	$1440
Capital expenditure. lessee..	$501	$2100	$5400	$1000	$5160	$601	$3450
Surplus capital, lessee.....	—$399	$900	$3600	—$600	$2760	—$1799	—$150
Annual earnings, owner.....	....	$282	$900	....	$775	....	$216
P. c. annual earnings, owner.	....	10	11	....	10	....	5
Annual earnings, lessee.....	....	$135	$540	....	$414	....	....
P. c. annual earnings, lessee.	....	6	10	....	8	....	....

Considered as a business enterprise, such results are hardly attractive. The hotel keeper or theatre man who cannot make 11 per cent profit in his legitimate business ought not to try to do it as an electric light manager. The estimate of $100 per kilowatt for the installation of the plant is low, for boilers, boiler setting, flue, stack, engines, generators, foundations, piping and switchboard; and this figure does not allow any margin for the building of sub-basements, partition walls and engine room floors, which are apt to be very considerable items.

As a matter of fact, however, the owner or lessee usually has a boiler, flue and stack, used for heating his building. He also employs an engineer, and reasons that he might well put in a lighting plant and use the exhaust steam for heating. Probably one-half of the steam can be thus utilized during the six months from Oct. 1 to April 1, in this latitude. The lighting load is apt to be heaviest during those six months, and there is plenty of steam to spare during the night hours. In the daytime, however, live steam must be used. The proprietor may decide to run his plant only at night, and to use gas during the daytime in places where light is needed. This is his best plan if he is afraid of a storage battery. Granting all this, it is unlikely that his plant will cost him less than $60 per kilowatt, even if he has suitable boilers and an ample stack, which is not usually the case. His operating expenses, properly chargeable to the electric plant may under the best conditions be practically cut in two. Part of his coal would have been used for heating during the night hours of the winter months anyway; in summer he will not require very much light. At the same time, he will save on his water bill by returning

TABLE III.

Estimated Annual Operating Costs of Steam-Driven Generating Plants. Load Factor, .20.

Amount of annual bill.....	$300	$400	$500	$800	$1000	$1500	$2000	$3000	
Size of plant, kilowatts.....	2	2½	3	5	6	9	12	18	Rate 20c. per kw-hr.
Annual output, kw-hours.....	2250	3000	3750	6000	7500	11,250	15,000	22,500	
Assumed economy, coal per kw, lbs..	32	31	30	28	27	24	20	16	
Cost of coal, at $5.00 per ton.....	$180	$233	$282	$420	$506	$675	$750	$900	
Cost of water, 10 per cent of coal..	$18	$23	$28	$42	$51	$68	$75	$90	
Cost of supplies, 25 per cent of coal.	$45	$58	$70	$105	$127	$170	$188	$225	
Cost of labor.....	$400	$400	$420	$450	$450	$475	$525	$600	
Total operating cost.....	$643	$714	$800	$1117	$1134	$1388	$1538	$1815	
Annual output, kw-hours.....	3000	4000	5000	8000	10,000	15,000	20,000	30,000	Rate 15c. per kw-hr.
Assumed economy, coal per kw, lbs..	31	30	29	26	25	20	18	12	
Cost of coal, at $5.00 per ton.....	$233	$300	$363	$520	$625	$750	$900	$900	
Cost of water, 10 per cent of coal..	$23	$30	$36	$52	$63	$75	$90	$90	
Cost of supplies, 25 per cent of coal.	$58	$75	$91	$130	$157	$187	$225	$225	
Cost of labor.....	$400	$420	$440	$460	$470	$525	$575	$650	
Total operating cost.....	$714	$855	$930	$1162	$1315	$1537	$1790	$1865	
Annual output, kw-hours.....	4500	6000	7500	12,000	15,000	22,500	30,000	45,000	Rate 10c. per kw-hr.
Assumed economy, coal per kw, lbs..	29	28	2	22	20	16	12	10	
Cost of coal, at $5.00 per ton.....	$325	$420	$505	$660	$750	$900	$900	$1125	
Cost of water, 10 per cent of coal..	$33	$42	$51	$66	$75	$90	$90	$113	
Cost of supplies, 25 per cent of coal.	$81	$105	$126	$165	$188	$225	$225	$281	
Cost of labor.....	$440	$450	$450	$475	$525	$600	$650	$725	
Total operating cost.....	$879	$1117	$1132	$1366	$1538	$1815	$1865	$2244	
Annual output, kw-hours.....	9000	12,000	15,000	24,000	30,000	45,000	60,000	90,000	Rate 5c. per kw-hr.
Assumed economy, coal per kw, lbs..	25	22	20	14	12	10	9	9	
Cost of coal, at $5.00 per ton.....	$560	$660	$750	$840	$900	$1125	$1350	$2020	
Cost of water, 10 per cent of coal.	$56	$66	$75	$84	$90	$113	$135	$202	
Cost of supplies, 25 per cent of coal.	$140	$165	$188	$210	$225	$281	$338	$505	
Cost of labor.....	$470	$475	$525	$550	$650	$725	$925	$1100	
Total operating cost.....	$1226	$1366	$1538	$1684	$1865	$2244	$2748	$3827	

the exhaust through the heating system to the boilers; and for a little more money than he pays his fireman he may get a good engineer to run the plant. Table V shows the result of this condition of affairs.

These results should be examined in the same light as those given in Table IV. It will be seen that the installations are only profitable

TABLE V.

Private Lighting Plants Exhausting into Heating Systems.
Price of Current, 20c. per kilowatt-hour.

Annual bill $300	$400	$590	$800	$1000	$1500	$2000	$3000
Operating cost 322	357	400	558	567	694	769	907
Difference ....—22	43	100	242	433	806	1231	2093
Capital expenditure, owner ..	287	667	1547	2880	5373	8207	13,950
Cost of plant, at $60.... ..	150	180	300	360	540	720	1080
Surplus capital, owner... ..	137	487	1247	2520	4833	7487	12,870
Capital expenditure, lessee ..	200	450	1100	2000	3700	5600	9500
Surplus capital, lessee... ..	50	270	800	1640	3160	4880	8420

at the larger sizes and with the higher rates of charge for current. We might draw vertical lines across Table IV. and Table V., marking

TABLE V. (Continued.)

Price of Current, 15c. per kilowatt-hour.

Annual bill	$500	$800	$1000	$1500	$2000	$3000
Operating cost.....	465	581	657	768	895	933
Difference	35	219	343	732	1105	2067
Capital expenditure, owner....	203	1460	2300	5000	7370	13,800
Cost of plant.....	240	420	480	720	960	1440
Surplus capital, owner.....	—37	1040	1820	4280	6410	12,360
Capital expenditure, lessee....	160	1000	1560	3330	5000	9400
Surplus capital, lessee.....	—80	580	1080	2610	4040	7960

Price of Current, 10c. per kilowatt-hour.

Operating cost	$683	$769	$907	$933	$1122	
Difference	117	231	593	1067	1878	
Capital expenditure, owner.... ..	780	1540	4000	7100	12,500	
Cost of plant..... ..	600	720	1080	1440	2160	
Surplus capital, owner..... ..	180	820	2920	5660	10,340	
Capital expenditure, lessee.... ..	530	1050	2700	4850	8540	
Surplus capital, lessee..... ..	—70	330	1620	3410	6380	

Price of Current, 5c. per kilowatt-hour.

Operating cost	$933	$1122	$1374	$1913		
Difference	67	378	626	1087		
Capital expenditure, owner....	405	2520	4173	7250		
Cost of plant.....	1440	2160	2880	4320		
Surplus capital, owner.....	—1035	360	1293	2930		
Capital expenditure, lessee....	300	1720	2850	4940		
Surplus capital, lessee.....	—1140	—440	—30	620		

the points at which a private plant has some chance of showing a saving; and these lines would be found to coincide almost precisely with lines drawn showing the graded systems of discounts and rates charged for current to large consumers. A glance at Table VI. will make this point clear.

TABLE VI.

WOULD A PRIVATE PLANT PAY?

Estimated from the Data Given Above; No Alterations of Buildings Included.

(*a*)

Without Using Exhaust Steam for Heating.

Amount of annual bill.	$300	$400	$500	$800	$1000	$1500	$2000	$3000
Rate 20c. per kw-hour..	No	No	No	No	No	Yes	Yes	Yes
" 15c. " " ..	No	No	No	No	No	No	Yes	Yes
" 10c. " " ..	No	No	No	No	No	No	Yes	Yes
" 5c. " " ..	No	No	No	No	No	No	No	No

(*b*)

Using Exhaust Steam for Heating.

Rate 20c. per kw-hour..	No	No	?	Yes	Yes	Yes	Yes	Yes
" 15c. " " ..	No	No	No	Yes	Yes	Yes	Yes	Yes
" 10c. " " ..	No	No	No	No	?	Yes	Yes	Yes
" 5c. " " ..	No	No	No	No	No	No	No	?

For the consumer whose position lies on the upper and right hand sides of the zig-zag lines, there are two courses open toward decreasing expense. The first is to install a private plant; the second lies to

TABLE VII.

Rates per Kilowatt to Meet the Competition of the Private Plant.

(*a*) *Where Exhaust Is Wasted.*	(*b*) *Where Exhaust Is Used.*
Bill, $1000; rate, 20c.	Bill, $500; rate, 20c.
" 1500; " 15c.	" 800; " 10c.
" 2000; " 5c.	" 1500; " 5c.
	" 3000; " less than 5c.

move downward till he crosses the horizontal portion of the line; in other words, to fight for a lower rate. This he ought to be able to do. A glance at the table shows what is the highest rate that the independent consumer can be expected to pay; and these results can be tabulated as shown in Table VII.

Unutilized Comforts of Electricity.

BY R. S. HALE.

Last fall the writer moved into a new house, and in connection with the moving had occasion to inspect a number of houses, some built several years ago and others just built. Nearly all, especially those recently built, were wired for electric lighting, but so few took advantage of the comforts to be obtained from electricity that a description of a few of the ways in which the wiring could have been improved may be of interest to architects and to those about to build or wire a house.

In most cases the lights were reasonably arranged for illuminating the rooms after the lights were lit. Electricity (including, perhaps, electric gas lighting), has, however, the great advantage over other systems that the lights can be turned on or off from one or more distant points, instead of it being necessary to go to the fixture itself. For instance, a system can be so arranged that the lights in a bedroom can be turned on from outside the door, so that one can flood the room with light before entering it, and no matter where the chairs or furniture have been placed, never need stumble over them in attempting to find the light.

For electric lighting, the way in which this is arranged is known as three-point wiring, and is shown in the sketch. What are known

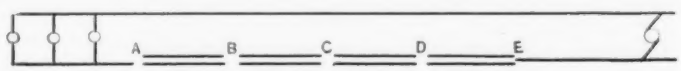


DIAGRAM OF THREE-POINT WIRING.

as three-way switches are placed at *A* and *E*, and four-way switches at the intermediate points *B*, *C*, *D*, etc. Then the lights can, if off, be turned on at any of the switches, no matter in what position the other switches have been left; or, if on, they can be turned off at any of the switches. This system is useful in many ways. One instance in which it is especially desirable, is to have all the hall and stairway lights on such a circuit, with one of the switches at the front door, one at the foot of the stairs, and one at the landing of each story. Then when one enters the house, turning a switch lights the hall, and there is no danger of stumbling over anything, for instance, a valise carelessly left in the way. Then after going up stairs the lights can all be turned off from upstairs, and it need never be necessary to go downstairs again to turn out a forgotten light and then go up again in the dark.

While it is generally most convenient to be able to light all the stair lights from any story, it may in some cases be thought undesirable to have to light all the upper landings if only one flight of stairs is to be used. In such a case the lights can be arranged as follows: The hall light controlled by two switches, one at the front door and one at the foot of the stairs, the light for the first flight of stairs controlled by two switches, one at the foot of the stairs next to the switch controlling the hall light, and one at the top of the stairs, the lights for the other stairs arranged in a similar way, so that as one came in or out one would turn out the light behind and turn on the light ahead.

Stair lights may be put at the landings at the top or bottom of the stairs whenever the stairs are straight. If, however, the stairs turn, as they do in most houses, it is very much more convenient to place lights at the turn to light both the top and bottom of the stairs.

Bedroom lights can be arranged in the same way as the hall lights with much comfort. For instance, I have a three-way switch at the door of my bedroom and the corresponding switch beside my bed. I light the lights as I enter the room, and have no fear of stumbling over the furniture. I turn out the lights after I am in bed, and can light them again without getting up, in case I have to rise before it is light. An even more luxurious scheme is to have a pendant switch to control a light, the switch itself lying on the pillow or under the bedclothes. With such an arrangement one can light the room without moving in the bed at all.

Another luxurious arrangement is to have an electric bed-warmer controlled by such pendant switch. Then if one wakes up in the night cold, all that is necessary is to press a button without even sitting up, and electricity does the rest.

Gas is frequently used in the servants' rooms of a house even when electricity is used in the master's rooms, on the ground of less expense. The back stairs, however, should always be lighted with electricity and provided with three-way switches as described above for

the front stairs. If gas, or electricity without three-way switches is used, the back stairs will be kept lighted all the time. With three-way switches and electric lights, they need be lighted only when in actual use. The switches on the back stairs should always be push-button switches and never turn switches. The lower price of turn switches often causes their use instead of push switches, but on the back stairs the servants will frequently have occasion to light or turn off a switch when carrying a tray or similar article. This can easily be done with a good push switch, but is difficult to do with a turn switch.

Sometimes, in the master's rooms, combination fixtures are used for both gas and electricity, but are always ugly. Instead, a drop-light connection for gas can be put in the canopy of the electric fixture, and a drop-light used when it is desired to use gas to save expense, or for any other special reason.

Every closet in a house should be provided with an electric light, preferably a light hanging from the ceiling of the closet which will light every portion without being in the way. The comfort of never having to grope in a dark closet or to take a greasy candle in among one's clothes is one of the greatest comforts of a properly lighted house.

The cost of all the devices spoken of above will not add 25 per cent to the cost of wiring a house, nor as much as that in many cases, and it will add 100 per cent to the comfort. Further, these devices will, if anything, reduce the cost of current. The closet lights are used for such a short time that the amount of current is inappreciable, and the three-way switches for the halls and bedrooms reduce considerably the amount of current used, since the lights are used only when needed, instead of being left burning all the time.

This article does not attempt to describe all the comforts obtainable by electricity, but only desires to call attention to a few of the comforts that are not generally realized, although the fact that they are available is by no means a novelty.

The International Electrical Congress.

The meeting in Section II, Sub-section B, Electric Lighting, on Friday, Aug. 24, adjourned from the previous day, was opened by the president, M. Hippolyte Fontaine. The minutes of the last meeting were read and approved.

M. Lorçay presented some notes on a new form of incandescent lamp in which the principal feature was a novel method of making an electrical connection without the use of plaster to secure the metal contacts. This consisted in making the base of the lamp with a T-shaped end, the platinum wires from the filament being brought up through the neck and brazed to two small contact plates on the upper side of the arms of the T, these plates being melted onto the glass by a special flux. Samples of the lamps were handed around. The sockets were of spring brass, longitudinal cuts being made at the mouth, giving the effect of leaf springs which, pressing on the tapering bulb, tended to force it outwards. A rectangular opening within the socket allowed of introducing the lamp, and a turn of 90 degs. caused the T-shaped end to rest in a cross groove, while spring contact pieces gave electrical connection. M. Lorçay said that it was customary in lamp manufacture to reduce as far as possible the use of plaster, as being an undesirable addition to the lamp.

M. Fontaine, in opening the discussion, said that he did not understand that much trouble was found with lamps as at present manufactured.

M. Meyer and M. Bainville both felt skeptical as to the merits of the new lamp. M. Bainville said that he did not believe the contact plates were sufficiently well fixed, and suggested that only a few experimental lamps had been made, to which M. Lorçay replied that several hundred had been manufactured, and that they gave good results in practice.

M. Stanoievitch, in the course of some remarks on the subject of wiring for electric light, said that it was usually more to the interest of the electric light company to put in the installations for customers themselves than to allow other concerns to do it.

M. Meyer believed that such a proceeding could only be considered in the case of a small station situated in a town where there were few or no contractors for wiring; that the system just proposed would incur heavy responsibilities for a large service, so that it would be better for the company in such a case to provide wiring only up to the building.

M. Bochet, discussing M. Monat's paper on "Electric Light and Power in Theaters," thought it was unnecessary for insurance regulations to cover details of installations, as in America, but that it was sufficient to indicate the general disposition of wiring.

M. Fodor, speaking of lamp filaments, said that short ones gave so little surface for emission of light that a disagreeable effect was produced. Long filaments gave better distribution from the surface of the bulb.

M. Fontaine said that low candle-power lamps for high-voltage circuits were now being made, and that several manufacturers were making lamps of 2 candle-power and 100 volts with an average efficiency of 4 watts per candle and a life of 300 hours.

M. Fodor called attention to the Nernst lamp, which was said to have a very high efficiency. He thought some trouble would be experienced in the connections to the filament when this was made very large, for high candle-power.

M. Weissmann said he had used lamps with very thick filaments, and did not think any difficulty was to be anticipated in securing the filaments properly.

Mr. Hoho read some notes on "New Methods of Regulating Distribution of Heat in the Lagrange and Hoho System." This is a means of heating by the well-known electric forge, but the novelty consists in directing the heat to those parts of the metal which it is desired to work, by covering the other parts by an insulating tube or plate. Close contact of the tube or plate is not required, as the layer of water between the insulator and the metal object prevents the passage of a current sufficiently strong to heat to redness. By this process steel plates or tools may be tempered at any predetermined part, and the rest of the piece be unaffected.

M. Blondin described briefly the resistances built by Messrs. Parvillée, which are formed of a paste of ceramic material and metallic particles. At the Exposition are shown many applications of this system to heating, and one of the best-known restaurants in the Rue des Nations uses these electric heaters for cooking.

Reports from other sections:

Colonel Renard discussed the formula given by M. Ernest Gerard for the resistance of a motor car—

$$f = 1.8 + .04\ V + \frac{.0415\ V^2}{T}$$

Expressing V in metres per second, and not kilometres per hour, the formula becomes—

$$f = 1.8 + .144\ V + \frac{.54\ V^2}{T}$$

Colonel Renard shows that the last term, which refers to the resistance of air, is in remarkable accord with the general results of experiments on plane surfaces. He also spoke of the importance of the shape of the fore and after parts of cars for high speeds.

Mr. Claude also read a paper on electrolysis from railway return currents, giving a résumé of the more important literature to date. his conclusions are that the ill effects of electrolysis are eliminated by an observance of the 5-volt drop rule, or even by limiting the drop to 1⅔-volt per mile, for the reason that either limits to 1.5-volt between rails and piping. M. Claude considers that the better rule would be to limit the latter pressure to 1.5 volts, and also that the connection of piping with rails should not be allowed.

M. Leon Gerard described the system of electric traction employed on the canal from Brussels to Charleroi. Three-phase currents are used, part of the energy of the line being devoted to lighting and power along the canal. The line is 48 miles long, and serves two substations, one 17 miles from Brussels and the other 6 miles from Charleroi. There are three generating units of 150 horse-power each, producing current at 6000 volts. Part of the current is used along the line for power and lighting. The haulage is performed by means of motors on four-wheel cars, which do not run on rails, but on the canal bank formerly used in horse traction. In places where traction by the motor cars become difficult, as in narrow passages at quays, etc., the boats are towed by electric launches receiving current from the line. The speed of haulage is 2.4 miles per hour for boats loaded, and 4.8 miles for empty boats. The efficiency of the generator is 93 per cent, and of the transformers 97 per cent. The efficiency between the dynamo and the boat towed is 27.5 per cent. The price of towing is one-tenth cent per ton. The system has been operating regularly since October, 1899, and moves 600,000 tons annually.

Prof. Janet presented a paper on rotary converters versus rectifiers, and from the considerations adduced offered the following conclusions: From one point of view it is evident that the use of transformer-

rectifiers takes the place of the induced and inducing systems of the rotary converter, the static transformer being employed in both cases. With respect to efficiency, the transformer-rectifier economizes a part of the hysteresis and Foucault current losses through the absence of variable fluxes in the transformer; though involving the use of a small motor, the advantage remains with it. As to operation, the advantage appears to rest with the rotary converter, as the rectifier with fixed brushes multiplies greatly the number of rings and collectors. In conclusion, Prof. Janet said that we have before us three solutions for the same problem—motor-generators, rotary converters and rectifiers—and it is very desirable to have practical data in order to make the necessary commercial comparison.

M. Boucherot presented a paper showing the applications possible of condensers in practical work. The cases are examined of the use of condensers in series and shunt for the neutralization of inductance, for phase splitting, in the excitation of alternators, etc. Condensers for circuits of 40 to 50 periods may now be purchased at from $16 to $30 per kilowatt. M. Boucherot considers that when the price of condensers becomes lower they will be much used on account of the increase of power factor involved and the greater security afforded.

In the discussion of a communication of Prof. Blondel and M. Gigouzo on curves from alternators, M. Duddell said he and M. Marchand had proved that the luminous efficiency of arcs diminishes with increase of efficiency. The note having stated that with respect to the extinction of the arc, there was an advantage in current curves of rectangular form, M. Arnoux remarked that little would be gained thereby, as experiments had shown that the arc would relight without difficulty. He considered that there would be little gain in economy with currents of rectangular form. M. Bochet said that the diminution of the luminosity of the arc is negligible except for very small currents; it has been found by experiment to be constant in lighthouse lamps for currents varying from 30 to 120 amperes.

In the discussion of M. de Fodor's paper, abstracted previously, M. Pellissier outlined a rate system in which the discount is based upon the number of lamps burning simultaneously, and not on the number installed. M. De Lutoslawski described the system in use in Warsaw, where discounts are accorded to consumers on the basis of an agreed maximum yearly consumption, the charge being based upon the ratio of a meter record for the year to the agreed value. M. de Fodor said he assumes a mean of 400 hours per lamp per year, which figure accords with statistics on the subject. He considered that the Wright system would be looked at askance, and that the use of maximum current cut-outs discouraged customers.

Captain Ferrié presented a paper on "decohering coherers" and the theory of coherers in general. He supposes that when two conducting surfaces are approached until separated by only a thin layer of dielectric, then if the two bodies have different potentials, a condenser is produced, the dielectric of which will break down if the difference of potential exceeds a certain amount. If the two conductors are approached still more, we can assume that the dielectric is crowded away from the points of the surface nearest to each other, thus producing a small empty channel between the two conductors. If now a difference of potential is established, a brush discharge occurs through this channel, and if the potential is raised still further, a spark passes. The author considers that the first case applies to ordinary coherers, and the second to decohering coherers consisting of an imperfect contact between carbon-metal surfaces.

M. Semenov gave an account of experiments with coherers, which showed that coherer filings are always oriented before the passage of current, thus sustaining the Lodge theory against that of Branly. Captain Tissot said he had been unable to detect orientation either with the microscope or through diffraction phenomena.

M. Bodde described a system for the utilization of wireless telegraphy in the prevention of collisions at sea. The transmitter is at the focus of a parabolic mirror, which turns about its focus and sends radiations successively in every direction in azimuth, these radiations being taken up by receivers on neighboring vessels by the ordinary means. In order that the transmitter and receiver of a vessel shall not influence each other, the author proposes alternately to throw in the receiver and transmitter by automatic means.

M. Arnoux described a hot-wire ammeter differing from the usual forms in the method of attaching the wire, and in the use of an exterior compensator for temperature. He stated that with this instrument, a deviation of 90 degs. was obtained with a consumption of .35 watt in the wire and a drop of only one-tenth volt. The compensator consists of a sheaf of wires of the same material as the hot wire, fixed parallel to the same, the whole being kept taut by a strong spring.

Prof. Janet described registering apparatus designed to study three arc lamps mounted in series. It gives a simultaneous record of the current and the three voltages on the same sheet, thus enabling comparison to be readily made.

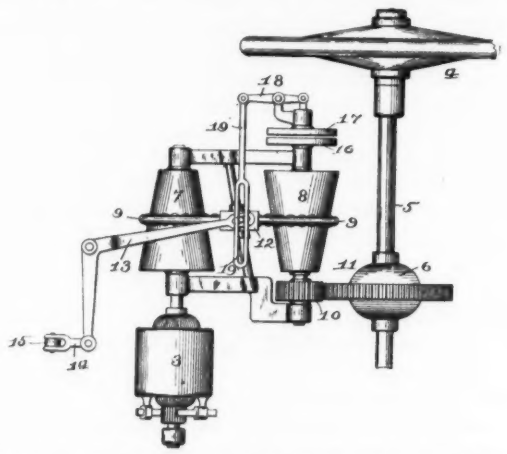
A paper presented by M. Lombardi described the construction of high-tension condensers, consisting of plates of paraffine and ceresine, which have been tested up to 17,000 volts. The dissipation of energy does not exceed 1 per cent, so that the temperature does not vary sensibly. The price has been lowered to $10 per kilowatt. With a power factor of .8 and a drop of 10 per cent, a condenser on a line may save 2 kilowatts for a capacity of 1 microfarad, and 1 kilowatt in the alternator. Mr. Lombardi considers that often the failure of a condenser is to be attributed to the e. m. f. curve on a circuit having a different form than that with which the condenser was tested. M. Leblanc supported this opinion, citing the case of machines tested at 4000 volts which punctured at 1500 volts when connected to concentric cables. The only remedy consists in eliminating harmonics, which can be done in the construction of a machine.

Prof. Blondel, in a communication on the graphical theory of the regulation of rotary converters, said that this type of machine may be considered as synchronous converters without transverse reactions.

Electric Automobile Control.

Mr. Clyde J. Coleman, who has already done other work in the electrical field, has assigned to the General Automobile Company of New Jersey a patent on electric automobiles which has for its objects, first, to provide a simple and efficient combination of the current reversing means and the speed regulating means, the connection being such that the manually actuated movable member of the current reverser is adapted to operate the speed regulating means and in which the electromotive current of the motor can only be reversed when the torque of the motor is at its minimum; second, to provide in connection with the coacting mechanisms referred to a brake active when the torque is the least upon the motor; and, third, a variable resistance or current controller adapted to vary and control the mortor circuit.

Fig. 1 is a fragmentary bottom plan of the driving mechanism of a motor vehicle embodying the present improvements; Fig. 2, a fragmentary longitudinal sectional elevation illustrating the current reversing and controlling mechanism and diagrammatically the arrangement of the operating electrical circuits, motor, etc. 1 represents a part of the seat portion of a motor vehicle; 2, the storage battery or other source of electric power; 3, the electric motor by which the vehicle is impelled; 4, one of the rear driving wheels; 5, the axle of such driving wheel, and 6 the casing of the equalizing



* FIG. 1.—PARTIAL PLAN OF DRIVING MECHANISM.

gear usual to power-driven vehicles; 7 and 8 represent a pair of coned pulleys connected together by a shiftable belt 9 and constituting the variable connecting gearing mechanism between the motor 3 and the axle 5 of the driving wheels of the vehicle, and to this end the coned pulley 7 will be connected to the shaft of the motor 3, as shown, while the coned pulley 8 will be connected by the pinion 10 and gear wheel 11 with the casing 6 of the equalizing gear upon the rear or driving axle 5.

12 is the sliding belt shifter engaging in the usual manner the belt

9 and receiving positive motion in either direction from a bell-crank lever 13 that in turn has operative connection by link 14 with the lower end or arm of the movable member or lever 15 of the current controlling and reversing mechanism, in order that the shifting of the belt in one direction or the other will be in unison with the movement of the movable member of the current controlling and reversing mechanism.

16 is a brake disk carried by the shaft of the coned pulley 8 and rotating therewith; 17 is a secondary brake disk made non-rotatable in its support, but capable of longitudinal movement upon its axis to or from the disk 16 to perform a braking action or release the disk from braking. 18 is a lever, one end of which is attached to the shaft of brake

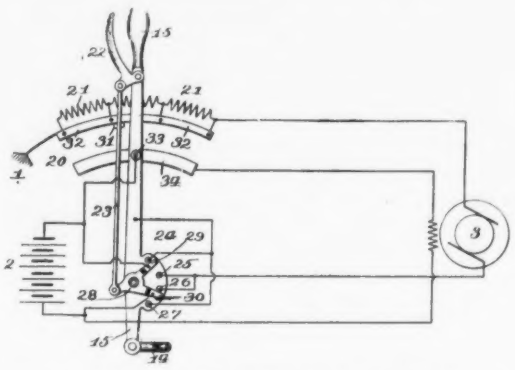


FIG. 2.—DIAGRAM OF CONTROLLING MECHANISM.

disk 17, while the other end has operative connection by means of a slotted link 19 with the sliding belt shifter 12, the connection being such that the braking action will only be effected when the belt connection 9 is at the smallest diameter of the coned pulley 7, in that with such position of the parts the operating lever or member 15 of the current controlling mechanism will be at or near the extreme limit of its off position, with the motor circuit broken; 20 is the stationary member of the current controller, formed with a series of insulated contact sections, as usual, to which the coils of the rheostat or variable resistance 21 are connected in series and are adapted in the shifting movement of the lever 15 to introduce a variable resistance into the motive circuit or to wholly break it.

In cases where an arrangement of batteries is relied upon to afford a variable e. m. f. or current to the motor such batteries will be connected to the circuit controllers in the usual manner, so as to be capable of being used in series or in series multiple at the will of the operator. One part of the invention involves, broadly, the combination of a current reversing switch and a variable speed mechanism, coacting together and operating in unison, and in a more restricted sense involves the combination, with such mechanism, of a current controlling mechanism, also coactingly connected and operating in unison.

In the attainment of the above results or functions an auxiliary means capable of independent actuation is attached to the operating handle of the movable member or lever 15 of the current controller and having operative link or other equivalent connection with the current reversing switch. In the particular construction shown in Fig. 2 of the drawings, as illustrative of one means of carrying out this part of the Coleman invention, a bell-crank handle or lever 22 is pivoted to the lever 15 near its upper or grip end, so as to be capable of operation by the hand of the operator that manipulates the said current controller lever 15. 23 is a link connection extending from the short arm of the lever 22 to the reversing switch mechanism to constitute an operative connection between the two.

The current reversing switch mechanism above referred to may comprise any usual type of reversing mechanism common to the electrical art. Such switch will, however, comprise opposed pairs of insulated contacts 24, 25 and 26, 27, arranged concentrically with the pivot axis of the operating lever 15 of the current controller and moving in unison with the lever as the position of the latter is changed and an oscillating member 28, pivoted on a common axis with that of the operating lever 15 and adapted to have movement independent of said lever. Such independently movable member 28 is provided with a pair of insulated contact pieces or fingers 29, 30, adapted to alternately contact with the opposed pairs of insulated contacts 24, 25 and 26, 27. This movable member is operatively connected to the link 23.

Another part of the invention deals with means whereby the variable gearing connection of the driving motor will be in that position in which a minimum torque or load is on the motor and preferably with the motive circuit broken before a movement of the current reversing switch can be effected to attain a reversal of the motor, the purpose being to prevent any liability of a burning of the motor windings due to a reversal of the current with a maximum load or torque upon the motor. In the mechanism shown 31 is a laterally projecting pin or stud on the link connection 23, adapted to engage either the upper or lower surface of the segmental confining bar 32 to hold the current reversing mechanism in either of its positions in a positive manner, the construction being such that the locking stud 31 can only be shifted from the top to the bottom surface of the confining bar 32 and vice versa, when the operating lever 15 of the current controller is in an open or starting position. The operating lever 15 is capable of an additional movement past the point at which it breaks current communication with the variable resistance 21, and the connections are such that such additional movement of the lever 15 is employed to effect the braking action of the driving mechanism as described. 33 is an insulated contact piece carried by the operating lever 15 of the current controller and connected with one pole of the battery; 34 is a fixed segmental contact plate connected through the field of the motor with the other pole of the battery. These are adapted to maintain the current upon the field of the motor at all times except when the current controller has broken the circuit to the armature of the motor, when the circuit to the field will be simultaneously broken and again re-established with the re-establishment of the armature circuit.

Telephone Jack and Rolling Indicator.

Mr. Oren R. Cline, of El Dorado, Kan., has recently taken out a patent on a telephone switchboard signal in which the indicating member is a ball, ring or disk. The mechanism in which this principle is embodied is shown in the accompanying Figs. 1, 2 and 3. Referring to the drawings, 5 represents a portion of a switchboard having a plurality of similarly equipped jack sockets in the usual manner, one of these openings being shown at 6 and formed with its front end of lesser diameter than the rear end. Within the opening 6 is a tube 7, arranged with its forward end tilted downwardly and terminating in the rear of the front face of the board 5. This tube 7 is adapted to receive an indicator element 8, shown in the form of a ball, of such a diameter as to move freely through the tube. The tendency of the ball is to roll down and become visible by projecting from the forward end of the opening 6. To hold the ball from displacement the contact point of the line spring 28 is bent to be in the path of movement of the ball for engagement. In order to hold the ball normally retracted to lie

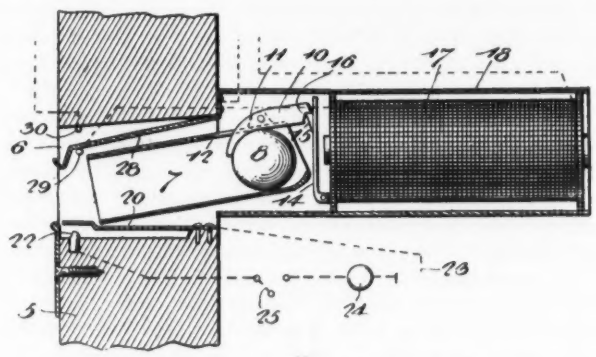
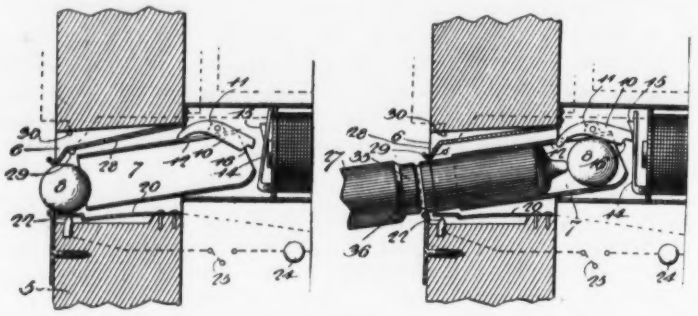


FIG. 1.—TELEPHONE JACK AND ROLLING INDICATOR.

at the rear end of the tube, an arc-shaped dog 10 is pivoted to an ear 11 upon the tube, one end of this dog being adapted to enter the tube through a slot 12. This end of the dog is adapted to lie against the ball 8 and between it and the front of the board 5 to hold it securely in position, and in order to hold the dog in its operative relation to the ball a plate 14 is pivoted at one end to a support and has a lug 15 upon its face to engage a notch 16 in the rear end of the dog 10. The position of this lug 15 is such that when engaged with the notch 16 the opposite end of the dog is projected inwardly of the tube 7, as shown in Fig. 1.

The plate 14 forms the armature of an electromagnet 17, to the

frame 18 of which the armature is pivoted. The magnet is disposed within an iron casing 18 to increase its efficiency, and this casing extends beyond the front end of the magnet and forms a means for the attachment of the magnet to the rear face of the board 5 and in its operative position. Thus if the magnet 17 be energized the armature formed by the plate 18 will be attracted and will draw the lug 15 from the notch 16, when the dog 10 will be released and will fall to the position shown in Fig. 2, and thus permit the ball 8 to roll down and project from the front of the switchboard. A spring plate 20 is secured to the lower wall of the opening 6 and below the tube 7, the free end of this plate extending forwardly beyond the end of the tube and into a position to receive the direct weight of the ball 8, when the



FIGS. 2 AND 3.—TELEPHONE JACK AND ROLLING INDICATOR.

plate will be depressed into contact with the contact piece 22. The plate and the contact piece are in the circuit of the battery 23, which includes also a bell 24, this circuit being adapted to be opened and closed also by a switch 25. Thus when desired the switch 25 may be closed, so that the bell will ring when the ball has rolled to the front of the board to perform its function of indication. A plug 27, of the usual form, is provided to engage the ball when in its indicating position and push it back to be re-engaged by the dog 10. A line spring 28 is disposed in the upper portion of the opening 6 to normally engage a contact 29, which is connected directly in the circuit of the magnet 17, this spring being adapted for engagement by the plug for movement from the contact to break the circuit of the magnet. When the circuit of the magnet is broken, the armature plate 14 will move away from the magnet and will lie in a position to engage its lug 15 with the notch 16 and hold the ball retracted after the plug is withdrawn. Above the spring 28 is a contact 30, which is connected with a ringing generator in the ordinary manner and lies in the path of upward movement of the line spring 28.

The plug 27 is of the usual construction, having a cord (not shown) which is of the usual flexible wire. The end of the wire which is attached to the plug is electrically connected with a ring or collar 35 upon the outer surface of the plug, this collar having a peripheral groove 36, which is so disposed that it will receive the angular lower end of the line spring 28 when the plug has been moved into the tube to an extent sufficient to engage the ball with the dog. When the line spring is in engagement with this groove 36, the plug cord is in circuit with the line, and the line spring is raised to lie in a position between and out of contact with the contact points 29 and 30.

After the ball has been released by the closing of the circuit of the magnet the parts will lie in the positions shown in Fig. 2. The plug 27 is then manipulated to press the ball 8 back and is at the same time raised to make contact between the line spring 28 and the contact 30 and is then dropped and moved on into the tube. This momentary raising of the plug is sufficient to close the circuit between the line spring and the contact 30 for a sufficient time to ring up, and when the plug has been moved all the way in the ball will lie in engagement with the dog 10, as illustrated in Fig. 1, and the end of the line spring will lie in engagement with the groove 36 to place the plug cord in circuit with the line.

The structure requires no act in returning the signals other than the mere insertion of the plug, the ball being positively returned and retained in a manner that will absolutely prevent accidental dislodgment, and consequently a false signal. When the mechanism of the invention is to be employed in connection with a complete metallic circuit, the usual and additional line spring is used and a double plug is employed. It is not stated whether any switchboards embodying this principle of operation have yet been built by the inventor. If they have, it will be interesting to learn the results of practical work.

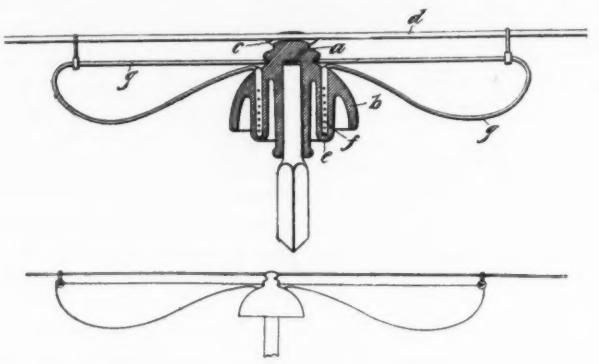
High Voltage Heated Insulator.

A patent has been granted to Mr. A. Sinding Larsen, of Frederiksvaern, Norway, on a new form of heated high-voltage insulator. The insulators for this purpose are generally made out of insulating material and formed with hoods or bell-shaped flanges, the purpose of which is to prevent moisture from forming a continuous conducting film or connection between the metallic conductor and the post or bracket carrying the insulator. It is known, however, that whatever form such insulator is given it is not possible to prevent the condensation of moisture unless special means are employed; and the object is to provide means for preventing such condensation on a part of the insulator to break the conducting surface or film.

The invention consists in combining with the insulator means for heating it so that a part of the insulator will always have a little higher temperature than the rest. The difference in temperature need not be very great, and only one degree Centigrade proves to be sufficient, because the moisture in the air surrounding the insulator will always condense on that part of the insulator that has the lowest temperature, notwithstanding the fact that the heated part may have a temperature low enough to condense the moisture. The moisture, so to speak, avoids the warmer one of two cold surfaces and only the colder one acts as a condenser. This heating of a part of the insulator may be performed by means of an electric current passing through a resistance enclosed in the insulator. For this purpose a very weak current is sufficient, about one-tenth of a watt under ordinary circumstances.

In the accompanying drawings Fig. 1 shows a vertical central section through the insulator. Fig. 2 shows in elevation an insulator, the conductor, and means for obtaining a current from the same to heat the insulator. In Fig. 1 *a* is the body of the insulator, having, as usual, a hood *b* and a slotted top *c*, in which the conductor *d* rests and to which it may be tied; *e* is an internal depending flange having an annular pocket in which a resistance coil *f* is embedded in an insulating material. This resistance coil or other resistance is connected to a separate conductor *g*, suspended, if desired, from the main line.

Instead of having a separate conductor along the line for the heating circuit, this latter may be arranged as a local induction circuit at each insulator, taking current by induction from the main con-



FIGS. 1 AND 2.—HEATED INSULATOR.

ductor, as illustrated, in which case the main line carries an alternating or pulsating current, or the heating current may be taken from the main line in any other suitable manner. Mr. Larsen shows, as an example of construction, a local wire *g*, connected to the heater *f* in the insulator and suspended and insulated from the main conductor *d*, which carries the alternating or pulsating current. By this arrangement a current will be induced in the secondary local circuit of sufficient strength to heat the coil *f* on the insulator. By the means shown the inner flange *e* will be given a higher temperature than the hood *b*, and the former will therefore remain dry and free from moisture, forming in this manner an insulating zone between the hood and the supporting part of the insulator.

Pocket Telephone.

M. A. Shelby, manager of the Lafayette (Ind.) Telephone Company, has invented a pocket telephone for use by police in cities where booths are not maintained. By inserting a small plug into a little box on a telephone pole connection is secured.

The American Electrical Works' Dinner.

Mr. Eugene F. Phillips, general manager of the American Electrical Works, Providence, R. I., defied the old superstition attached to "thirteen" by giving the Company's annual Rhode Island clam dinner to the electrical fraternity on Sept. 13. His defiance of the superstition was justified, as the day was an auspicious one, and every one present voted the dinner a great success. The first gathering was in 1878, eighteen men being present, of whom three are still living, in spite of their annual attendance at these clam dinners. At this, the twenty-second annual dinner, 350 guests were present. The guests gathered at the Narragansett Hotel in the morning, from where they were conveyed in special trolley cars to the Pomham Club, at Pomham, beautifully situated on the banks of Narragansett Bay. A light luncheon was served upon the arrival of the party at the club, and the guests then proceeded to enjoy the various forms of amusement provided for them, such as target-shooting, bowling, billiards, quoits, etc.

The clambake was served at 2 p. m., the sea and the mudbanks vieing with each other in giving up their delicacies to tickle the palates of the guests. The dinner was an excellent one and well served. With coffee and cigars came the toasts, Mr. T. D. Lockwood, of the American Bell Telephone Company, acting as toastmaster. Mr. Eugene F. Phillips welcomed his guests. The toast "The City of Providence and State of Rhode Island" was responded to by Mr. D. J. Hayden; "The Telegraph," by Prof. Elisha Gray; "The Legal Fraternity," by Colonel Van Slyck; "Power Transmission," by Major R. S. Brown, of the Westinghouse Electric & Manufacturing Company, and "The Technical Press," by Mr. J. M. Wakeman, of ELECTRICAL WORLD AND ENGINEER. Each guest received a souvenir of the occasion, a very handsome copper match safe.

CURRENT NEWS AND NOTES.

MR. B. B. ODELL, JR., the Republican nominee for Governor in New York State, is the active president of the Consolidated Gas & Electric Light, Heat & Power Company, of Newburg, N. Y.

RECEIVER CASES.—Mr. W. J. Murdock, of Boston, has taken out a patent on making telephone receiver cases in one operation, the shell being molded or cast around all or some of the parts as desired, and the parts being held in place by the material. The method applies to watchcase and butter-stamp receivers alike.

LOW WATT LAMPS.—Some lamps tried recently by Mr. E. Lacomblé, electrical engineer for the city of Brussels, have shown a consumption of only 1.9 watts per candle, but he does not record their life. A useful life of 500 hours to 600 hours is claimed for them by the manufacturers, the Usine Nationale des Lampes a Incandescence, of Brussels.

DIAMOND SETTING.—Mr. George Anderson, of Carnonstie. Scotland, has patented in this country a method of setting diamonds or other precious stones electrically by drilling a hole in the metallic holder, nearly through, inserting the stone in the hole, bringing the holder electrically up to a welding heat and then closing and welding the sides of the hole back of the diamond. He then grinds away the superfluous metal so as to uncover the diamond in its firm sheath.

TROLLEY TURN-OUT SIGNAL.—A patent has been issued to Mr. G. H. Dunham, of Quincy, Mass., on a signal for single-track trolley turn-outs, to guard against collisions. The car cuts lamps in and out in its progress by means of circuit closing and breaking boxes, in which a rolling ball is employed to close the circuit and light the lamp. This use of a rolling ball is found again, it may be noted, in a recent patent in which it is shown as a telephone signal, in place of a drop. It has also been used before for contact-making purposes.

THE ALASKA CABLE.—The Alaska Cable Expedition sailed from San Francisco on Sunday, Sept. 2, per steamer Orizaba. The vessel is under charter to the Kerite Company, represented by Mr. Geo. F. Porter. Other members of the cable party were Mr. R. D. Brixey, Mr. Alex Klein, of New York, who handles the cable, and Mr. John M. Klein, of San Francisco. The Orizaba was provisioned and coaled for the round trip, which will take one month with favorable weather. The cable is 187 miles in length, and will be laid from St. Michaels to Nome.

TELEGRAPH LINES IN ALASKA.—A report has been received from General Greely, Chief Signal Officer, who went to Alaska to arrange for telegraphic communication with that Territory, which says that by making use of the Canadian line there will be communication with Fort Egbert, Eagle City, by the end of September. The Canadian line extends from Ashcroft north to Dawson City and the boundary line. The United States has constructed a line from Fort Egbert to meet this line. Another line is being built by the United States up the Yukon River, which, it is intended, shall connect with Fort Egbert, but it is not likely that it will be completed this season.

A DISCLAIMER.—Canvassers claiming to represent an organization styled the Telegraphers and Typewriters of America are soliciting donations and advertisements, etc., for a souvenir programme which, it is said, will be published in connection with a proposed telegraph tournament. These canvassers, we are informed, and have reason to know, are making statements calculated to give the impression that the Postal Telegraph Company indorses the organization. They are referring to Mr. Chas. P. Bruch, assistant secretary and assistant general manager of that company, as being actively interested in the movement. Mr. Bruch writes us: "The Postal Telegraph-Cable Company has not indorsed this organization, and references to me in connection with it are unauthorized."

AN APPETITE IMPROVER.—A recent special despatch from London gives the following serious story: It has been discovered that London's "Two-Penny Tube," as the new underground electric railway is called, confers another benefit besides rapid transit. The enervated and debilitated are now resorting to it as a means of restoring lost appetite. This strange suggestion was first made by a gentleman who avers he had suffered from loss of appetite for eighteen months, but who, the first day he travelled in the "Two-Penny Tube," reached home ravenous, and has maintained an appetite ever since by the taking of a journey every two or three days. This tonic is ascribed to the ozone generated by the electricity.

HOME PROTECTIVE LEAGUE.—A new organization is the Home Protective League at Rochester, N. Y. It is organized along the lines of the law-enforcement leagues, but with a broader scope. Its objects are to protect its members against the invasion of private rights, as citizens and property owners, by telephone, telegraph, street railway and other corporations, who "without right or consent use property as though the owner were not a factor to be considered"; to co-operate with the municipal government to bring about the enforcement of ordinances; to look after the public health by insisting, for instance, that garbage be collected regularly, and to protect the morality of the home by its surroundings. It is also hoped to bring about better street car service, better lighting on some of the streets, the abatement of nuisances, and so on. An attorney is to be employed, and each case of invasion of rights is to be litigated.

ENGLISH STREET RAILWAYS.—A special dispatch from London of Sept. 15 says: There is much gossip over the statement that Charles T. Yerkes, of Chicago and New York, has secured control of the stock of the Charing Cross, Euston & Hampstead Underground Railroad, and it is hinted that the denial made in this connection by Mr. Smith, the secretary of the company, is by no means conclusive. It is pointed out that there are some evidences of truth in these reports, and Mr. Yerkes' friends openly declare that he has not only secured this valuable opening, but that his coming to London means that he will control the electrical traction system of the metropolis. Nor is London the only place where American capitalists are engaged in electrical enterprises. The next few days will probably see the completion of plans for the construction and consolidation of a system of 120 miles of suburban lines connecting Manchester, Liverpool, Bolton and a score of smaller towns in the most poulous district of Northern England. This project is in the hands of Messrs. Tom L. and Albert L. Johnson, of New York.

LONDON UNDERGROUND.—Mr. C. S. Smith, a member of the New York Rapid Transit Commission, who has been inspecting the new electric underground in London, says: "The London elec-

tric railroad is certainly a great improvement over anything London has ever had. But, after all, it is not rapid transit in the sense we understand it in the United States. The distance from the Bank of England to Shepherd's Bush is 400 yards short of six miles. This is covered in 25 minutes, including 13 stops. This is done by means of two single-track tubes, which, of course, prevents the running of express trains. The New York line will contain four tracks, and express trains will run from City Hall to the northernmost end of the island in from 18 to 19 minutes. The engineering work in London is admirable, and the rolling stock is an improvement even on that of the New York Elevated Railroad, as the cars are better lighted and better furnished."

GERMAN DELIVERY OF GOODS BY STREET CARS.—Consul Hughes reports from Coburg, Saxony: In the Mittheilung des Vereins für Local und Strassenbahnwesen will be found an interesting paper giving details as to the way in which goods traffic is managed in three German cities—Gera, Frost, and Spremberg. They are not large places, but industrially very active, especially in textiles. The power used on the tramways is electricity or steam; the goods are transferred at the station into smaller trucks, or the railway cars are taken over the town lines. At Frost, there are three morning and three afternoon deliveries. At Gera, perambulator cars, with flangeless wheels apart from guide wheels, have been tried with indifferent success. All these plants have been worked with a profit for several years, and though people have grumbled, the utilization of tramways for the goods traffic has points which can not be dismissed without due consideration.

A TELEPHONIC EPISODE.—In the little hamlet of Bateyville, in southern Louisiana, A. Gautreaux conducts a store, dealing in diversified merchandise. Mr. Gautreaux has his store equipped with a telephone and a double-barreled shotgun. The combination of shotgun and telephone seems to have worked well, until the other day, when a thunderstorm passed over Bateyville, and a lightning bolt made its way into the store over the telephone wire. The electricity leaped from the transmitter to the shotgun and caused the discharge of both its barrels. Two heavy charges of the large-sized shot betook themselves through the side of the building, narrowly escaped a group of men gathered for shelter to leeward of the store, and proceeded into the landscape. The episode would have ended then and there had not Mr. Prudent Ayre, much startled by the explosion of the gun, and in excitement and alarm, grasped with a frantic clutch the rapidly revolving circular saw near which he was working! As a result he lost several fingers that he could ill spare, and his hands were severely mangled.

LUFFA STORAGE BATTERIES.—Mr. W. Bowker, Sr., of Waltham, Mass., has taken out a patent on a method of cheapening and simplifying the production of secondary battery plates by utilizing a natural vegetable fibrous network, such as loofah or luffa, as the binding medium for the lead oxide or active material, into which the active material or lead oxide is placed in the form of a paste. The network is thoroughly filled with this paste, after which the battery cell or plates are formed through a long and continuous charging of electricity—say for one hundred hours, more or less, or until the paste and network form a solid mass. After this the plates are in a condition to store electricity. The advantages claimed are as follows: The plates are light in weight and may be manufactured cheaply. The liquid acid can percolate through them quicker and more freely than in the ordinary way. It is found by actual test that the loofah resists the action of the acids used in secondary or storage batteries. Mr. Bowker says as to loofah, that there are quite a number under the natural order of *Cucurbitaceae* of the tribe *Cucumerineae*.

AUTOMOBILES IN WAR.—With regard to the use of automobiles in the recent French army manœuvres, a special dispatch from Paris of Sept. 15 says: A striking feature of the operations is the introduction on an extensive scale of motor vehicles in order to secure a practical test of their military utility. Several of the generals and most of the members of their staffs have been furnished with fast, light motor cars, which have proved of the utmost value. The generals' aides-de-camp covered unprecedented distances in a few hours recently. General Brugere's orderly officer ran 170 km in the morning, making a complete circuit of the two contending armies and furnishing General Brugere with full details of the situation by noon. Where auto-cars can be utilized, the use of horses by generals and messengers would appear doomed. Heavy forage and provision motor wagons are also doing valuable work for the commissariat. The roads around Chartres simply swarm with auto-cycles, motor cars and wagons worked by electricity, petroleum and steam. Accidents are inevitable, but they have been very few, considering the number of motors.

CANADIAN NIAGARA POWER.—While the development of water-powers in electrical operations is one of the characteristic features of the day, the development of electrical energy on the Canadian side of Niagara Falls seems to be no further advanced than it was ten years ago. Whatever deals the Ontario Government has lately made with electrical companies, they appear to have had the effect of only tying up the work of development instead of promoting it. Last year the Government rescinded the monopoly of the United States Company, which theretofore held the franchise, and made provision whereby other companies could obtain rights to develop electrical power at the Canadian falls. More than a year and a half have elapsed without any substantial progress being made, and there is little indication of development work being undertaken in the near future. It is now advanced that the development of electrical energy at the Canadian falls by the Ontario Government would immensely benefit the country within a radius of 100 miles, and that Government ownership and operation of a gigantic electric plant is the best solution of the problem.

AN ACETYLENE SIGNBOARD.—On the Canadian side, at Niagara Falls, acetylene gas is put to a novel use in that it is employed to illuminate a sign 80 ft. long. This sign is located at the water's edge in the gorge, and is the property of the Maid of the Mist Steamboat Company, the boats of which company run in the gorge at the foot of the falls. Quite naturally, in a place so popular as Niagara, there are many visitors in the great free parks after nightfall to get the evening view, or a moonlight view, of the falls and waters. To command their attention, the steamboat company erected the sign referred to. It is about 80 ft. long, and the letters are arranged like this: "Maid of the Mist." The larger letters have a height of 6 ft., while the smaller letters are 4 ft. high. In all, 120 quarter-foot burners are used, and over each burner there is a red globe. The generator used is a 150-light machine manufactured by the Acetylene Gas Machine Company, of Niagara Falls, N. Y., and is located in a small wooden building about 100 yards back of the sign. It costs from 25 to 27 cents an hour to operate the lights, and the cost of the outfit was about $300.

DANGEROUS PLATED WARE.—Mr. W. Schumann, U. S. Consul at Mainz, Germany, writes the State Department as follows: "A Frankfort newspaper calls attention to the fact that for some time past, certain kinds of silver-mounted glass and porcelain wares, such as cups, glasses, jars, vases, etc., have been placed upon the market. The silver on these articles is applied by means of a galvanoplastic process, in baths which contain very large quantities of potassium cyanide. As glazed wares have innumerable hairlike cracks, this deadly poison enters these cracks; and the articles, beautiful to look at, become a severe menace to the health of anybody using or handling them, especially as it is impossible in the course of manufacture to remove this poisonous residuum. Only a short time ago a very severe case of poisoning resulted from the use of such ware. I have spoken with a member of the firm of Martin Mayer, the largest manufacturers and exporters of jewelry in this consular district, in order to ascertain the accuracy of the foregoing assertions. I was informed that the statements were perfectly true and the danger lurking in these articles was not in the least exaggerated. My informant said that his firm refuses to manufacture these wares on account of the danger to the workmen, as well as to any one using the goods."

AUTOMOBILE AMBULANCES.—Roosevelt Hospital, in New York City, is adding two electric automobiles to its ambulance service, costing about $3,000 each, and being gifts. They are 7 ft. 6 ins. long on the inside, this being 18 ins. longer than most ambulances, and have room for three reclining patients, while eight can be crowded in it if they are able to sit up. The physician, instead of sitting at the back of the ambulance, will sit at the left side. There are windows of plate glass, so that the physician can look out on either side. He can speak to the driver through a speaking tube. The batteries to operate the motors are carried in a box which is suspended from the

body of the vehicle, and they do not have to be removed for recharging. When the ambulance reaches the stable after responding to a call, a charging plug is inserted and the batteries are at once charged. For emergencies there is an extra set of batteries which can be placed in position in two minutes. The ambulances can run twenty-five miles on one charge. The motors are independently connected to the two rear wheels. The drivers of the new ambulances will sit on the left side of their seats instead of the right. A lever controls the steering gear. The tires are of solid rubber 3 ins. in diameter. The ambulances are provided with brakes which will bring them to a dead stop within six feet when running at full speed.

A MODIFIED MOVING PLATFORM.—Mr. John Perry, president of the English Institution of Electrical Engineers, is credited with being the author of a rather novel application of the "moving platform" in connection with boarding and alighting from moving railway trains. It had seemed to him that on the underground road in London much time was lost and a great amount of energy wasted in stopping and starting the trains. In order to avoid this waste he suggests the following device: At each station the platform is a turntable, about 500 feet in diameter. This turntable is kept concontinuously revolving at such a rate that its rim travels at the same speed as the moving train. At the centre of the turntable is a spiral staircase, which, being in the centre, of course moves very slowly, by which the passenger reaches the main floor. He then walks toward the circumference. The speed at which he is being carried along gradually increases, until at the edge he is traveling at the rate of the moving train, which he here finds seemingly at rest, and with the doors open. He enters, and as the moving platform is left behind the doors are automatically closed, until the next station is reached, when they are automatically opened again. With such an arrangement the track, of course, at each station would be built on a curve closely following that of the turntable, for about half the latter's circumference. Mr. Perry thinks that with this system it might be expedient to have a continuous train, on such roads as the underground of London, or the elevated of New York City, so that no matter when a passenger might arrive, he would always find a car open and apparently waiting for him. There are a number of obvious difficulties, not the least of which would be the great expense of such a construction, and the danger which might result from the occurrence of any sudden inequality between the two motions. It is, however, said to be not at all improbable, however, that something of the sort will in the near future be put to a practical test in London.

TELEPHONE SWITCHING APPARATUS.—In large towns and cities the telephone exchange is usually divided into several central offices located at varying distances from each other which are connected to one another by trunk or toll circuits, and it frequently happens that some of the sub-station and the toll circuits are provided with magneto-generators to operate call-bells and electromagnetic line-signals, while other sub-stations and toll circuits are equipped with means such as a centralized or common battery for automatically operating bells and signals. When such is the case, both kinds of circuits may have their switching terminals and line-signals upon the same keyboard-sections at the central stations, and in order that the operators may make the switching connections between the terminals of the same or the diverse kind of circuits, two or more kinds of linking or cord circuits have had to be furnished. An invention of Mr. D. S. Hulfish, assigned to the American Bell Telephone Company, relates to special means embodied in linking or cord circuits whereby sub-station and toll circuits of the same kind or of diverse kinds may be connected to each other at the same section of the switchboard-table and by means of the same pairs of cords and plugs, so that the disconnecting or supervisory signals are readily operated with every possible combination of connections and without requiring switch cords and plugs of diverse character. By means of the invention it becomes possible to connect two common-battery circuits with each other, a common-battery circuit with a magneto sub-station or toll circuit, or two magneto-circuits with each other, and to inductively unite the two plugs of a cord circuit by the introduction of a repeating-coil in order that two connected circuits of the same kind may repeat into each other, and also that a magneto-circuit may be enabled to repeat into a common-battery circuit, and vice versa. The magneto-generator circuits are provided at the central station with socket-switches and a line-signal and the test-rings of the sockets are grounded, and the common-battery circuits are provided with socket-switches, a line-signal, and also with a cut-off relay, all in the usual manner, the apparatus at the stations at the opposite ends of both kinds of circuits being of the ordinary character. To effect the combination of circuits indicated a cord-circuit is provided having disconnecting or supervisory signals adapted for each class or kind of circuit with means for associating the proper signals with the special combination of circuits interconnected and for operating the same and for suppressing the signals which are not appropriate for said combination. Means are also provided whereby current from the central station may flow in the common-battery circuits to energize the transmitters located therein, also to prevent the current from passing to the magneto-circuits, and for energizing the transmitters in the magneto-circuits, and for introducing and withdrawing a repeating-coil between the conductors of the cord circuit at the will of the operator, so that the same and diverse kinds of circuits may be conductively separated from one another.

LETTERS TO THE EDITORS.

Resonance or Coherence?

To the Editors of Electrical World and Engineer:

Sirs:—In the London *Electrician,* Aug. 31, 1900, some leading remarks are made regarding a phenomenon that was noted in incandescent lamps during an electric display accompanying a storm. I have noted the very same thing, viz.: a momentary increase in brightness with each lightning flash, but would look for the explanation not in a coherer effect in the carbon filament, but in the increased voltage of the line, due to resonance. Conditions are not favorable to the ordinary manifestation of the latter condition, but the varying periodicity of the discharge will make them so, though only for an instant.

If we are to accept the statement made by Prof. Elihu Thomson, to the effect that not all lightning discharges are oscillating in character, I am strengthened in my belief, as in several instances the momentary brightening in the lamps was absent. L. S. LEVY.

SCRANTON, PA.

Feed Pump Efficiencies.

To the Editors of Electrical World and Engineer:

Sirs:—It will undoubtedly interest not a few engineers who are operating dynamos, as well as the superintendents of electric light and power plants, to learn something of the economy in their feed water systems. The writer has had occasion in several instances to make duty tests of the feed pumps of various isolated plants, and has obtained negative results from a standpoint of economy when comparing the merits of two methods of feeding boilers.

Upon investigating the comparative merits of electrically-operated feed pumps to those taking steam from the boilers of their plants, the writer has found that in most cases when small steam pumps are operating on various loads having a maximum speed of about 50 full strokes per minute, the actual steam consumption on a basis of a 2 horse-power load when operating at this speed, will be on an average of about 130 lbs. of water per horse-power per hour, but when in use feeding the boiler, the wide fluctuations in the steam consumption of the engine during the varying loads demanding more or less water than the full capacity of the pump, gives rise to considerable variations in the speed of the pump, which seriously affects its efficiency. That is, taking the duplex pump as an example, the strokes are not complete, and taking as a fair average of the pump's speed one-half of its maximum, the steam consumption of the pump would increase in some instances to 180 or as much as 200 lbs. of steam per horse-power per hour. Therefore, upon a nominal basis of feed, it would be fair to assume a steam consumption for the steam pump of 180 lbs. of water per horse-power per hour. This is what is found to be about the consumption of these small steam pumps in practice, and figuring on a basis for a boiler evaporation of 8 lbs. of water per pound of coal, such as the anthracite pea which is in common use in New York State, and particularly in New York City, which is a fair average for a ten-hour run, we would have a coal consumption for 300 days of 135,000 lbs., or 62 gross tons. This would have to be charged up to the steam consumption of the pump, and, at $3.25 per gross ton, would amount to $201.50. The cost for cylinder oil for the steam end of the pump would be about $5.50, making a total of $207.

A pump driven by an electric motor of about 2 horse-power ca-

pacity will have about the same friction loss in its operation in consequence of gear, etc., as the steam pump, or probably a trifle less. Allowing a total loss of 40 per cent in the dynamo which operates the motor, the loss in the motor itself, as well as in the windings, and a steam consumption of 28 lbs. of evaporated water per horse-power per hour for the prime mover, which is a fair average of the water consumption of our modern power plants, we have a consumption of 39 lbs. of water per horse-power per hour for working the electrically-driven pump. This on the same basis as the steam pump would amount to 28,222¼ lbs. of coal for the same time, or 13¼ gross tons, which would amount to $43.06. The lubricating expenses would be about the same for both pumps, any slight difference, however, being in favor of the electrically-driven pump.

The steam pump would have to be charged up with an annual expense of about $5 for the steam end of the pump for repairs, which would make a total expense for maintaining the steam pump, irrespective of the investment, of about $212 annually. For the power pump the repairs would not exceed $2 per annum, which would bring the total expense up to $45, leaving a saving in favor of the power pump, omitting investment, interest, etc., of $177 on the maintenance of the pump alone.

As there is less than one-quarter or nearly one-fifth of the amount of water evaporated in the boiler for the operation of the electrically-driven pump, there would be about one-fifth of the amount of incrustation and deposit of scale taking place in the boiler due to the excess which would be formed in consequence of operating the steam pump. Therefore, the extent to which the boiler would be depreciated by the evaporation of the water necessary to operate the prime mover at full load would be still further depreciated by the steam pump to the extent of about 10 per cent, which means, if an allowance of 10 per cent is made for depreciation, say on $1,000, $100 of this amount would have to be charged annually to the steam engine, and about 10 per cent of this would have to be booked against the steam sucker, which would swell the expense of operating the steam pump annually another $100. As this is also true of the depreciation in the furnace by the use of the steam pump, we find it goes all the way back to the grate bars, smoke stack, etc.; therefore, it would be fairer to the electrically-driven pump to figure a depreciation of 10 per cent on the whole cost of the boiler plant complete, including erection, and on the basis of a 180 or 200-hp boiler, including stack, setting, etc., costing about $2,300, we would have to charge up $230 annually to the engine, and 10 per cent of this, or $23, to the feed pump. This would have to be added to the fuel expense. Thus it will be seen that the saving in the running expense of the electrically-driven pump would amount annually to $200, which sum would more than pay for a new pump.

Of course, the same saving might be effected with an ordinary power pump taking its power from a line shafting. The difficulty with this scheme, however, would be apprehended in the regulation of the feed water. In the electrically-driven pump the feed water supply may be varied at will.

The writer would be pleased to learn something of the experiences of other engineers in this connection, as it would appear that there is plenty of room for argument both in favor of and against the use of steam pumps as boiler feeders where electric power is accessible.

NEW YORK CITY. PHILIP K. STERN.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

Standardization of Electric Machines.—DETTMAR.—A paper read at the recent annual meeting of the Union of German Electrical Engineers, in which he strongly recommends that regulations should be drafted by the Union for the rating of the power and the determination of the rise of temperature and of the efficiency of electric machines. Regarding the determination of the rise of temperature he remarks that temperature elevations, determined by the increase of resistance, are generally greatly in excess of those measured by thermometers, and that this excess may be 40 per cent for armatures and 60 per cent for magnet coils; the maximum increase of temperature, however, is obtained by neither method; measurements made by determining the increase of resistance, give about a mean value between maximum and minimum; the maximum increase of temperature in the interior of a coil may be assumed to be 1.5 to 1.8 times the value found with the thermometer. He has made some experiments in order to determine the highest temperature which wires covered with cotton and paper insulated wires can stand; for cotton-covered wires in rest a temperature of 95 degs. C. appears to be well admissible; for cotton-covered wires which are subjected to mechanical shocks, however, this temperature seems to be the maximum which might be allowed, and should better not be used in good machines. Paper-insulated wires, if in rest, can stand a temperature of 115 degs. C.; if they are moved, the maximum temperature which may be allowed is 105 to 110 degs. For the determination of the efficiency he remarks that the method of determining all the losses, individually, etc., has the great advantage that it is a purely electric method; he makes some remarks regarding the determination of the single losses. In commutating machines the loss due to commutator brush-contact resistance ought not to be neglected, especially if carbon brushes are used; there is a considerable difference between the values of this loss if carbon or copper brushes are used; therefore the efficiency of a machine is different in both cases; if the efficiency is wanted for different loads, this kind of loss is to be determined for the different currents, and no mean value ought to be used. Regarding the magnetic hysteresis loss, he remarks that no conclusive proofs have so far been given for the statement sometimes made that Steinmetz's formula is not correct if an iron core is revolved in a constant magnetic field (see, for instance, Digest, Jan. 6, Scott); he shows that Niethammer's criticism in this regard is unfounded.—*Elek. Zeit.*, Aug. 30.

REFERENCES.

Ferranti Rectifier.—An illustrated article giving a summary of the Ferranti arc light system which has been in use for some years in many British cities. It enables to combine practically all the advantages of a direct current supply to arc lamps with those of alternating current transmission, without any duplication of types of plant in the generating station. This is accomplished by the Ferranti rectifier, which converts varying alternating current supplied by the generators at a constant potential, into unidirectional constant current at a varying voltage. The three essential parts, namely, the constant current transformer, the synchronous motor, and the high-tension commutator driven at synchronous speed by the motor, are described and illustrated by diagrams.—*Lightning*, Aug. 13.

Motor.—POOLE.—A well-illustrated article, giving a design for a 3-hp motor.—*Amer. Elec.*, Sept.

The Moment of Inertia of the Rotor of a Dynamo.—HAY.—The conclusion of the article noticed in the Digest, Sept. 15. He describes four more methods for determining the moment of inertia and describes tests in which he has applied them.—*Lond. Elec. Rev.*, Aug. 31.

Wave Form of Alternators.—HERDT and ARCHIBALD.—A Canadian Elec. Ass'n paper, illustrated by many diagrams, on the conditions affecting the wave form of alternators, especially on the change of wave form with the character of the load.—*Elec. Rev.*, Sept. 5.

Motor Generator.—PARKER and GROVER.—An illustrated article in which they describe some experiments made with a motor generator which was built after a certain design, but did not behave as expected. Their experiments related to the reasons of this shortcoming.—*Amer. Elec.*, Sept.

LIGHTS AND LIGHTING.

Alternating Current Arc Lamps.—LENART.—A brief paper read before the Int. Soc. of Elec. in Paris and describing a new alternating current arc lamp of Ganz & Company. The feature is said to be that nearly the whole light emitted is used for the illumination of the lower hemisphere. The carbons are not vertical, but inclined, each

forming an angle of 45 degs. with the vertical line, so that they are perpendicular, one to the other. A simple mechanism is used to keep the distance of the ends of the carbons constant. Above the carbons a reflector is used. The lamp consumes 10 or 16 amperes at a pressure of 30 volts at the terminals. For three 12-ampere lamps in series with regulating resistances, to be used on a 105-volt supply network, 1290 watts are required; the candle-power of a 12-ampere lamp is 500, so that one candle requires 0.86 watt.—*Bull. de la Soc. Int. des Elec.,* June.

Behavior of Incandescent Lamps During Thunderstorms.—An editorial note on a curious phenomenon observed frequently in the incandescent lamps on the circuits of the Calcutta Electric Supply Company at times when Calcutta has been visited by exceptionally severe thunderstorms. "Immediately following each lightning flash the brightness of the glowing lamps has been observed to increase suddenly, gradually returning to their normal incandescence." The only conceivable explanation, although rather extraordinary, is said to be that this is a phenomenon similar to that observed in a coherer in wireless telegraphy, where carbon undergoes a sudden decrease in resistance when subjected to electrical radiation. It may be possible that the carbon filaments of a lamp may undergo a similar change when exposed to the influence of a tropical thunderstorm in its immediate vicinity; a sudden decrease in the resistance of the filament would produce a correspondingly rapid increase of the candle-power, after which the gradual self-decoherence of the carbon would account for the return of the lamp to its normal incandescence.—Lond. *Elec.,* Aug. 31.

High-Efficiency Incandescent Lamps.—An article discussing the question at what limiting charge for current the high efficiency lamp with short life is to be preferred to the low efficiency lamp with long life. The life of a lamp is assumed to be the number of hours during which the lamp will, when consuming its standard number of watts per candle at the standard voltage, emit a candle-power which does not sink below 20 per cent less than the initial rated candle-power. Low efficiency is defined as 4 watts per candle and high efficiency as 3 watts per candle. A 4-watt lamp is assumed to have a life of 1000 hours, a 3-watt lamp a life of 400 hours. The price of both lamps to the public is taken at 25 cents. If the price of the kilowatt hour is 2¼ cents, one lamp is as good as the other, if the labor involved in renewals is neglected. For a price of 5 cents per kilowatt hour the economy effected by the use of the 3-watt lamp represents a saving of 44 cents in every 1000 hours.—Lond. *Elec. Rev.,* Aug. 31.

Lighting Installation.—An illustrated description of the lighting installation of the new Chicago Coliseum, which is a large convention hall. There are 180 enclosed arc lamps, 80 of which are suspended from the centres of the ten middle arches in coronas of eight each, while the remaining 100 are distributed around the sides of the hall. All are 500-watt lamps, rated at 2000 candle-power each, and operated at 110 volts direct current. Each of the twelve arches contains a row of 76 incandescent lamps of 10 candle-power each, which are mounted on birch strips, the wiring running through two covered grooves. Four of these wooden strips are hinged together and form the suspension for one-half of each arch.—*West. Elec.,* Sept. 8.

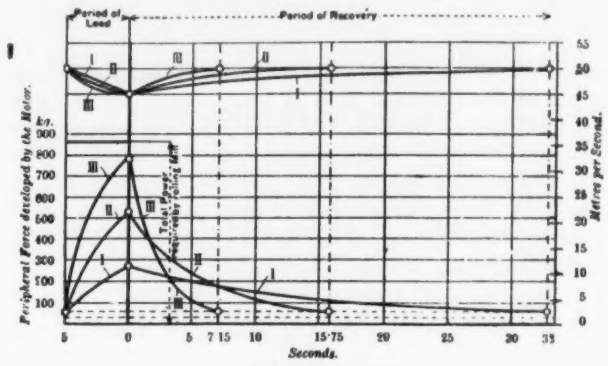
REFERENCES.

Nernst Lamp.—Some editorial remarks on the Nernst lamp and street lighting. It is said that an enormous simplification of the street lighting question may be expected as one result of the development of the Nernst lamp, and that it would appear that arc lamps are doomed.—*Amer. Elec.,* Sept.

Submarine Arc Lamps.—An illustrated description of an enclosed arc lamp protected by a watertight casing. The supply of oxygen within the casing is sufficient to allow the lamp to be used continuously for 10 to 12 hours, at the end of which time the carbons will also have to be renewed. The lamp is of 2000 nominal candle-power.—*Eng. News,* Sept. 6, and *Elec. Rev.,* Sept. 5.

Decorative Illumination.—A description, with illustrations, of the Court of Honor for the Grand Army Encampment in Chicago, for which were used 2800 incandescent lamps of 16 candle-power.—*West. Elec.,* Sept. 8.

Electric Driving of Iron Works and Rolling Mills.—LASCHE.—An illustrated article on the electric driving of the rolling mills of the Oberspree cable works of the General Electric Company, of Berlin, three-phase induction motors being used throughout. After some introductory remarks on the feature of induction motors, especially on the slip, he remarks that a motor might be considerably smaller than corresponding to the maximum power required, as the momentum of a flywheel can supply momentarily a part of the requisite power. He deals at great length with the working of flywheel rolling mills. He first examines in what way the motor must be reinforced by the flywheel and what are the considerations to be made in calculating the size of the motor and the flywheel. There are two main periods in the cycle of operations: First, that in which work is done, and secondly, the period of recovery; the latter implies the time during which the motor stores up energy in the flywheel, to be employed usefully in the next period of work. He shows how to calculate the combined action of flywheel and motor and represents it graphically. In the adjoining diagram three examples are worked out, in each of which the duration of the period of load as well as



POWER CURVES.

the slip of the motor is taken at the same value; a different size of motor has been taken in each case, however, and the necessary weight of flywheel and time required for recovery has been calculated. As maximum load on the motor, one and a half times the normal load has been assumed. The maximum power from motor *I* is 170 horse-power, from motor *II* 320 horse-power, from motor *III* 470 horse-power; the slip is 10 per cent in all cases; the period of load is 5 seconds in all cases; the period of recovery is 33 seconds, 15.75 seconds and 7.15 seconds, respectively; the equivalent flywheel masses are 690, 530, 318, respectively. The three upper curves, *I, II, III,* in the diagram, represent variations of speed. The three lower curves, *I, II, III,* in the diagram, represent the peripheral force developed by the motor, so that the relation of the power supplied by the motor and that supplied by the flywheel (during the period of work) or supplied to the flywheel (during the period of recovery) can be found. It follows from these diagrams that when there are only small pauses between two roller grooves, and thus only a short period of recovery, a large motor in connection with a light flywheel must be chosen, while with longer waits between two individual grooves a smaller motor with a heavier flywheel suffices. He further gives diagrams, comparing three cases, where the sizes of the motor and of the slip are taken the same in the three cases, and the duration of the period of recovery and the necessary flywheel weights determined for diffrent periods of load; in this case the periods of recovery as well as the flywheel weights increase proportionally with the duration of the period of load, so that for long periods of load heavy flywheels must be chosen, and there must be long periods of recovery. Finally he gives diagrams, in which the period of work and the size of the motor are assumed to be fixed and three different values for the slip of the motor are chosen, and the necessary flywheel weight and period of recovery calculated; in this case, the smaller the slip allowed, the larger must be the dimensions of the flywheel. He gives some diagrams, in which are plotted the results of tests of power consumption and velocity in the rough and fine rolling mills at the cable works of the Gen. Elec. Co. of Berlin.—*Tech. Centralblatt;* an English translation in abstract in Lond. *Elec.,* Aug. 31.

Gas Engines.—KRONE.—A paper discussing the advantages of gas engines for the generation of electric power. He gives detailed estimates of the buildings, plant and working expenses of four different systems, each designed to supply a moderate-sized town with electric light and power to the extent of 4000 incandescent lamps of 16 candle-power and 100 horse-power for motors; the first system is operated by steam engines without condensation, the second with condensation, the third with ordinary illuminating gas, and the fourth with Koerting's gas plant. Illuminating gas, compared with steam of both descriptions, shows an annual saving of $1525 and $2200, respectively; Koerting's gas gives a saving of $1330 and $2005, the cost of coal being assumed at $4.50 per ton. He also gives details of the Clausthal electric plant with Koerting's gas plant, which supplies

3500 incandescent lamps of 16 candle-power, 155 of 25 candle-power and 50 horse-power for electric motors. An average of 707 watt-hours is generated per kilogram of coal.—*Zeit des Ver. Deut. Ing.*, 1900, p. 39; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

REFERENCES.

Gearing.—A very long paper, with many diagrams and illustrations. The defective construction of the connections between machinery and the motor driving it is frequently the cause of unsatisfactory results. In this paper the ordinary defects are discussed, the principles involved are demonstrated, and the result of a series of observations conducted by the General Electric Company of Berlin are given.—*Zeit. des Ver. Deut. Ing.*, 1899, pp. 1417, 1487, 1528, 1563; briefly abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

Electric Crane.—An illustrated description of an electric traveling crane used at the Romback Iron Works to raise ladles of molten metal, weighing 15 to 20 tons, and to empty them into the converters.—*Zeit. des Ver. Deut. Ing.*, 1899, p. 414; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

Transmission Line.—An illustrated description of the line transmitting three-phase current at 20,000 volts from the power house at St. Gabriel to Quebec, Canada.—Lond. *Elec.*, Aug. 31.

Electrically Operated Organ.—A brief illustrated article on the operation of the blowing apparatus of church organs by electric motors.—*El'ty*, Sept. 5.

Small Central Station.—Mather.—An illustrated article on the steam equipment for small central stations.—*Amer. Elec.*, Sept.

Electric Power in Bridge Building.—Dunlap.—An article on work done at Niagara Falls.—*West. Elec.*, Sept. 8.

TRACTION.

Load Factor of Traction Stations.—Booth.—An article in which he gives an approximate formula of simple form for the load factor of a traction station. The load factor is equal to 1.33 multiplied by the cubic root of the number of kilowatt hours generated in the station in a complete week of seven days. The constant 1.33 will not hold good for every case, but for all cases so far as tested it is a mean value, and in no case does the actual value fall far on either side. When the weekly output exceeds 400,000 kilowatt hours, the load factor would become more than 100 per cent, according to this rule; it may then be assumed that there is an absolutely steady load on the power plant.—Lond. *Elec. Rev.*, Aug. 31.

Railway Motors on Grades.—Some editorial remarks referring to the fact that some tramway cars crawl up a grade in a hesitating sort of way, while others ascend quickly. The latter do so at the expense of excessive heating, while the slower motors are not so liable to overheat. The torque is proportional to the product of magnetic flux and armature current; consequently the slow motor in which the magnetic lines of force increase somewhat proportionately to the current in the field winding, requires less current to exert a given torque, than the faster machine, which must depend almost solely upon the increase in armature current for any increase in torque beyond the normal.—*Amer. Elec.*, Sept.

Electric Launches.—An article on the nature, construction and arrangement of the storage battery, the motors and regulating appliances of the most approved launches in Germany. Among them are some built for the Berlin Industrial Exhibition of 1896, carrying 60 passengers and provided with an 18-hp motor and a battery of 80 cells, with a capacity of 500 ampere hours, the weight of electrical plant and machinery being 7 tons. Also a large steel freight-boat of 67 tons is described, with a motor of 20 horse-power and a battery of 45 cells; with a single charge this vessel makes a 5-hour trip at a speed of 7 miles.—*Zeit. des. Ver. Deut. Ing.*, 1899, p. 1456; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

REFERENCES.

Interurban Electric Railway.—A well illustrated description of the power station and equipment of the Dayton, Springfield & Urbana (Ohio) electric railway, which has a length of 40 miles.—*Amer. Elec.*, Sept.

Birmingham.—Halstead.—An article on the electric railway in Birmingham, taken from a U. S. consular report.—*Elec. Rev.*, Sept. 5.

Paris.—Gosselin.—A reprint of the English translation of his paper on the Bois de Boulogne combined trolley and surface contact tramway, noticed in the Digest, Sept. 15.—*El'ty*, Sept. 5.

Automobile Exposition.—Mayer.—An article giving some notes on electric automobiles at the automobile exposition at Frankfort, Germany.—*Centralblatt fuer Accum. und Elem. kunde*, Sept. 1.

Milde Automobiles—A well-illustrated description of electric automobiles of Milde & Co. The motor is of the differential type, with two independent armatures, placed end to end in one magnetic field, with compound excitation. Each armature drives one wheel. The accumulators used are of the Heinz type.—*L'Ind. Elec.*, July 10.

Electric Locomotives.—An illustrated description of two electric locomotives, one used in shunting at the Hoesh Steel Works and the other in the mines at Esch in Luxemburg.—*Zeit. des Ver. Deut. Ing.*, 1900, p. 376; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

Street Car Motors.—Parham.—An illustrated article on "a running test of street car motors." When the two motors are switched in series the two counter e. m. f.'s ought to be equal if the motors are alike in every respect. He discusses the different reasons why this is not the case in practice.—*Amer. Elec.*, September.

Measuring Instrument for Tramways.—Kapp.—A reprint of the English translation of the German paper noticed in the Digest, Sept. 8 and Aug. 11.—*Elec. Rev.*, Sept. 5.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Periodicity of Alternating Current Apparatus.—Andrews.—A paper read before the Ohio Electric Light Association on the periodicity of alternating current apparatus. He takes each periodicity separately and discusses its value as regards transformers, line losses, induction motors, synchronous motors, synchronous converters, incandescent lamps, arc lamps, parallel operation, and the different systems. The following frequencies are discussed: 125, 60, 40, 25. For small plants doing lighting alone, with scattered load, high frequency and single phase ought to be selected; for general lighting, with a moderate amount of power, 60 cycles polyphase, and for general power, with a moderate amount of lighting, 40 cycles, and for power alone, using synchronous converters, 25 cycles. Of all the frequencies mentioned, the one which seems to be the most universal in its application, where power is required, is 40 cycles.—*West. Elec.*, Sept. 8.

Danish Power Plant.—Winslow.—A description of the electric lighting and traction plant at Frederiksberg, Copenhagen. The capacity of the steam dynamos aggregates 700 kilowatts. There is also a storage battery with a capacity of 260 ampere hours used for traction, and another storage battery with a capacity of 1350 ampere hours for lighting. The lighting network is laid out on the three-wire system, with 220 volts between the outers. The aggregate length of the tramway is 7 miles; the trolley system is operated at 550 volts.—*Ingenioven* (Copenhagen), 1899, p. 295; abstracted at some length in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

REFERENCES.

Switch Gears for High Pressure Alternating Currents.—Warrilow.—A continuation of the illustrated serial (Digest, Sept. 15), in which switch gears of Fowler & Sons and Siemens Bros. are described.—Lond. *Elec.*, Aug. 31.

Taunton.—The first part of an illustrated description of the new electric lighting plant at Taunton. In this part the former plant is described.—Lond. *Elec. Eng.*, Aug. 31.

Guernsey.—Some supplementary notes, with illustrations, to the article noticed in the Digest, Aug. 25.—Lond. *Elec. Eng.*, Aug. 31; another illustrated description of this plant in Lond. *Elec.*, Aug. 31.

Load Curve.—An illustration, with brief description, of an abnormal lighting load curve which was recently obtained in Manchester during a very heavy thunderstorm in the afternoon, causing a sudden and heavy demand on the generating plant and batteries.—Lond. *Elec.*, *Elec. Rev.*, *Elec. Eng.*, Aug. 31; *Lightning*, Aug. 30.

WIRES, WIRING AND CONDUITS.

REFERENCES.

Grounding Certain Portions of Distributing Systems.—Wordingham.—A reprint of the Brit. Munic. Elec. Ass'n paper, abstracted in the Digest, Aug. 11.—*El'ty*, Sept. 12.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetic Hysteresis.—Dina.—An account of experiments in which he compares the hysteresis loss per cycle, when the magnetizing force is varied, as in a stationary transformer, or when the iron core is revolved in a constant magnetic field, as in a revolving arma-

ture core. Up to an induction equal to about 10,000 c. g. s. units, the hysteresis is greater in the revolving core than in the stationary core; beyond that value the former is smaller than the latter, and the difference increases with increasing induction.—*Rendiconti del R. Inst. Lomb. di sc. elett.*, ser. 2, v. 33; abstracted in *Elek. Zeit.*, Aug. 30.

Resistance of Solutions of Salts in Movement.—AMERIO.—A paper criticizing the investigation of Bosi, who had found that movement modifies the resistance of salt solutions, and that for solutions which become more concentrated by electrolysis at the positive pole, the resistance is increased when the direction of the movement is opposite to the direction of the current, and that for solutions which become more concentrated by electrolysis at the negative pole, the resistance is increased, when the direction of the movement and that of the current are the same. The present author says that Bosi's experiments were all right, but the conclusions drawn by Bosi are not justified, as the change of resistance is only apparent.—*Il. Nuovo Cim.*, Oct., 1899; abstracted in *L'Eclairage Elec.*, June 16.

Transmission of Electricity Through Warm Air.—KHESSIN.—An account of experiments with a porcelain tube containing two platinum discs as electrodes. The air becomes a conductor at 550 degs.; the conductivity increases quickly when the temperature increases, but decreases when the e. m. f. increases. The maximum conductivity corresponds to a distance of 2 mm between the electrodes. —*Soc. Ph. Ch. Russe*, v. 31, p. 6; abstracted in *L'Eclairage Elec.*, June. 16.

REFERENCES.

Thermodynamics of the Electric Current.—LIEBENOW.—A paper on the hypothesis which is used for the explanation of thermoelectric phenomena and states that every current of heat produces an electric current, and vice versa (Digest, July 29, 1899). He attempts to account for this by assuming that the heat consists in the vibrations of the negative electrons. Anything which moves these negative electrons will move the heat attached to them by convection, and so every electric current will go hand in hand with a heat current.—*Ann. der Physik*, No. 7; briefly abstracted in Lond. *Elec.*, Aug. 31.

Wave Form of Alternating Currents.—RICHTER.— Some remarks on Benischke's paper, abstracted in the Digest, Sept. 8; he recommends to use both form factors, that of Fleming and that of Benischke, and to distinguish them by different names.—*Elek. Zeit.*, Aug. 30.

Masses Smaller Than Atoms.—PERKINS.—An article giving a general summary of researches of J. J. Thomson on the structure of the atom, which were noticed at repeated times in the Digest.—*Science*, Sept. 7.

Thermoelectricity.—MACLEAN.—The first part of a Royal Society paper, giving an account of a continuation of his researches on the effects of strain on the thermoelectric qualities of metals. In this part he discusses the thermoelectric difference between free wires and wires previously subjected to longitudinal extension and lateral compression, by drawing them through the holes of a draw plate; further, the thermoelectric difference between free wires and wires previously permanently elongated by longitudinal stresses; further the thermoelectric difference between free wires under stress, producing temporary elongation or permanent elongation.—Lond. *Elec. Eng.*, Aug. 31.

Pressure and Resistance of Metals.—LUSSANA.—An account of experiments on the influence of the mechanical pressure upon the electric resistance of metals. The resistance decreases when the pressure increases, the decrease of the resistance being not proportional to the pressure, but tending to a limit.—*Il Nuovo Cim.*, Aug., 1899; abstracted in *L'Eclairage Elec.*, June 16.

Pressure and Resistance of Electrolytes.—TAMMANN.—An account of an investigation of the influence of mechanical pressure upon the conductivity of an electrolyte. The theory is based upon the hypothesis of ions, especially upon Planck's formula for the relation between the degree of dissociation and the external mechanical pressure.—*Wied. Ann.*, v. 69, p. 767; abstracted in *L'Eclairage Elec.*, June 16.

Nature of Electricity.—FLETCHER.—A reprint of his notes on Shettle's view of the ultimate nature of electricty, noticed in the Digest Sept. 15.—*El'ty*, Sept. 5.

Hertzian Resonator.—TURPAIN.—A French Academy paper describing experiments in which he investigated the electric conditions of a Hertzian resonator in activity. He enclosed it in a glass tube of circular form, containing rarefied air, and studied the phenomena of luminosity.—*Comptes Rendus*, June 5; *L'Eclairage Elec.*, June 16.

Cathode Rays.—An illustrated article describing some experiments of Curie with cathode rays.—*Sc. Amer.*, Sept. 8.

Spectrum of Radium.—DEMARCAY.—An account of an investigation in which he identified certain strong and bright spectrum lines and also a band with radium. His results bring its spectrum into close analogy with the spectra of the metals of the alkaline earths.—*Comptes Rendus*, July 23; abstracted in Lond. *Elec.*, Aug. 31.

Magneto-Optics.—CORBINO.—An account of an experimental investigation relating to the reciprocity of magneto-optic phenomena, especially to the Sheldon effect. He tried to verify this effect by different methods, but the results were entirely negative.—*Il Nuovo Cimento*, v. 10, p. 408; abstracted in *L'Eclairage Elec.*, June 16.

ELECTRO CHEMISTRY AND BATTERIES.

Frasch Electrolytic Process.—A very interesting article on "the Hans A. Frasch electrolytic process for extracting metals, as applied to copper-nickel matte." The information given is based upon a full personal investigation of the process by J. Struthers, of the staff of Mineral Industry. "This process bids fair to revolutionize the present methods of extracting not only copper and nickel from their ores and metallurgical products, but appears adaptable as well to the winning of silver, mercury and other metals that have heretofore offered almost insurmountable difficulties to their economical extraction in the wet way." The process, as applied by a Canadian company to copper-nickel matte, consists of the electrolysis of a brine solution in such a manner that while the sodium ions are set free at the cathodes with the immediate formation there of caustic soda, the chlorine ions are liberated in the anode section containing the matte and immediately form a chloride solution of the metals present. The caustic soda is thus a by-product, while the solutions of metallic chlorides, produced by the combination of the chlorine with the metals in the matte, can be directly treated for the contained metals by electrolysis or chemical methods, or after being electrolyzed of half its content of copper—corresponding to the conversion of the cuprous salt to the cupric salt—it may be used for the lixiviation of the metals in the raw matte, the copper chloride solution being in the cupric condition acts chemically as a solvent for the metals in the matte and reforms the electrolyte solution suitable for further electrolysis. The mechanical side of the process is described as follows: The matte is submitted to a coarse crushing and is then conveyed to the vats, where is it charged directly on a layer of carbonaceous material that forms the anode section at the bottom. On this layer of matte is placed a thin layer of sand which gives a very satisfactory diaphragm for the separation of the resultant solutions of caustic soda and the chlorides of the metals. The anode section of the vat is then filled to the sand layer with a saline or a weak chloride solution from a previous operation, and the balance of the vat is filled with water or with a weak caustic solution. The passing of the two solutions from the reservoirs to and through their respective anode and cathode sections of the vats and thence to receiving tanks is accomplished mainly by gravity. The subsequent handling of the solid material which remains in the anode section after treatment, consists of the removal of the upper layer of sand, which can be washed and used again, followed by the removal of the leached material, from which perhaps it might prove economical to extract the sulphur. The results of a test are briefly given. It is claimed that the entire cost of the process will be fully met by the value of the caustic soda and other by-products. "The exhibition of the Hans A. Frasch process in the present case leaves nothing at which the public can cavil."—*Eng. and Min. Jour.*, Sept. 8.

Production of Ozone.—OTTO.—A long description of his rotary ozonizers, which may be divided into two principal classes: rotary ozonizers with movable electrodes, and such with stationary electrodes. The principle upon which both classes alike act is that if two electrodes connected with the two poles of a circuit of high potential are brought near enough to each other, an electric discharge will take place between them across the intervening space, and on then gradually increasing the gap the discharge will cease when the gap becomes too wide. If an arc has been accidentally formed during the discharge, it will be broken by the wider gap. He describes in detail the forms of his ozonizers, and discusses the use of ozone for the purification and sterilization of drinking water by a twofold method, in which a set of mixers and a nest of trays are used in suc-

cession; further, for bleaching and dyeing, for mellowing of wines and spirits, for the oxidation of oils, perfumery and coloring materials, for the purification of air in hospitals and private houses.—*Mem. de la Soc. des Ing. Civ. de France,* 1900, pp. 149-200. Some critical remarks, by Gosselin, on Otto's paper and a favorable discussion of the use of ozone for commercially purifying water, in the same journal, p. 221; abstracted in *Brit. Inst. Civ. Eng. Abstracts,* v. 141, pt. 3.

REFERENCES.

Dyeing and Printing Works.—SUNDERLAND.—A paper giving some notes on the application of electro-chemical processes in dyeing and printing works.—Lond. *Elec.,* Aug. 31.

Electrolytic Production of Soda and Chlorine.—HOBART.—A continuation of his illustrated serial (Digest, Aug. 25). He describes and discusses several forms of cells.—*Amer. Elec.,* September.

UNITS, MEASUREMENTS AND INSTRUMENTS

REFERENCES.

Electric Clock.—An illustrated description of an electric clock devised by Vacotti. A dry cell or an hermetically closed cell of the Leclanche type is enclosed in the clock and furnishes the driving power for more than two years.—*Cosmos,* Sept. 1.

TELEGRAPHY TELEPHONY AND SIGNALS.

Wireless Telegraphy.—An illustrated description of the Slaby-Arco system of wireless telegraphy, the advantages of which, as compared with other systems, consist not in a superiority in respect of the distance, but in its practical serviceability, prevention of danger from high pressure, avoidance of difficulty of insulation in the transmitter, and of atmospheric disturbances in the receiver, together with a greater solidity and simpler manipulation of the whole receiving apparatus. It is based upon the same principles as the Marconi system, but differs from it in some special points. The vertical wire is connected with earth for both the transmitter and receiver. The connections of the transmitter are shown in Fig. 1, where *J* is a 40

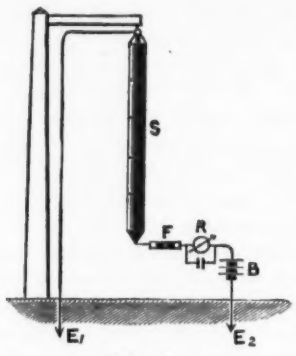


FIG. 1.

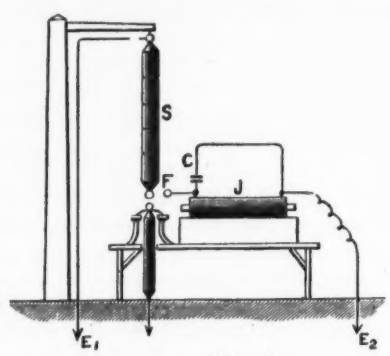


FIG. 2.

or 50 cm induction coil with a mercury turbine contact breaker, connected to a direct current supply; if alternating current is available, the induction coil may be directly connected to it and the contact breaker can be wholly dispensed with. A condenser *C* is charged from the secondaries of the induction coil, and discharges itself on one side through the spark gap *F* and on the other side through E_2 direct to earth. The condensers used are made of micanite. The arrangement of the receiving apparatus is shown in Fig. 2, where *S* is the aerial wire netting, *F* the coherer, *R* the relay of the Morse instrument and *B* the battery. When the initial high resistance of the coherer has been reduced by the ether waves, the battery *B* sends a current through the relay, the aerial wire and earth. A characteristic feature of the receiver is that not only a simple aerial wire but also an earthed wire cage or netting may be used; while in previous arrangements the waves which reach the coherer were shunted by the local circuit, and their effect was thereby weakened, in the Slaby-Arco system the series arrangement adopted completely removes this defect; atmospheric disturbances are also greatly reduced by the series arrangement. Another improvement consists in the automatic interruption of the coherer circuit, which is so arranged that the blow of the tapper is only given to the coherer tube after the tension of the coherer elements is taken off. At present signals can be safely transmitted to distances from 25 to 28 miles over sea with vertical wires 38 to 44 yards high. The system has been adopted by the German navy. It is also used by the General Electric Co., of Berlin, for maintaining communication between their central office and their Oberspree cable works, a distance of 9 miles, the vertical wires of 55 yards height being supported by two tall chimneys.—Lond. *Elec. Rev.,* Aug. 31.

REFERENCES.

Protection of Telegraph and Telephone Wires in Connection with Overhead Traction.—An article discussing and criticizing the paper of Quin, abstracted in the Digest Aug. 18.—Lond. *Elec. Rev.,* Aug. 31.

Interior Telephone Systems.—HENRY.—A continuation of his illustrated serial noticed in the Digest Aug. 25. He continues to discuss intercommunicating systems.—*Amer. Elec.,* September.

Wireless Telegraphy.—An article in which it is said that Marconi has now solved the problem of synchronizing messages, "by means of variable conductors and capacities, by the use of which certain instruments can only receive certain messages." He is also said to utilize now cylindrical tin cans, about 5 ft. in height, instead of the vertical wires.—*Sc. Amer.,* Sept. 8.

Cable Steamer.—An illustrated description of the new German cable steamer Von Podbielski, noticed in the Digest June 2.—*Sc. Amer. Sup.,* Sept. 8.

MISCELLANEOUS.

Physiological Effect of Alternating Currents.—RUNG.—A description of experiments, made by Prof. Weber, on the physiological action of alternating electric pressures on the human body. Two classes of experiments were made with a view to settle, firstly, the risk when both hands simultaneously touch both bare leads; secondly, the risk when a person standing on the railway or on a car touches one or the other of the leads. From his experiments regarding the first point, Weber infers "that all pressures exceeding 100 volts are dangerous when contact is made with both poles of an alternating current circuit; and since this pressure produces muscular fixation, there is a decided risk of fatal consequences, the victim being unable to release himself." From the second class of his experiments, made by him while standing on moist gravel soil, he inferred "that to touch a single pole is not dangerous if the pressure does not exceed 1000 volts." These experiments were made to settle a dispute between Brown, Boveri & Co., and the local authorities controlling the Stansstadt-Engelberg three-phase electric railway; the contractors proposed 750 volts, while the authorities would not allow more than 500 volts. Weber's experiments, it appears, were regarded as sufficient justification for using 750 volts. In the abstract, from which this is taken, the experiments are said not to be conclusive: first, the effect upon different individuals is different; second, it is not sufficient to investigate the mere pressure which the human body can stand; regard must be paid not only to the pressure, but to the amount of horse-power at the back of it, as well as to the inductance and electrostatic capacity of the circuit from which the discharge is taken.—*Civilengeener* (Denmark); abstracted in Lond. *Elec.,* Aug. 31.

Danger from Electricity in Mines.—WALKER.—An article on the sources of danger from coal dust ignition in a mine. "Neither the electric arc nor a glowing wire can bring about an explosion of coal dust alone, in the absence of fire-damp." Moreover, the arc lamp is hardly likely to be used in positions where coal dust is present in large quantities owing to the low penetrative power of its rays through such an atmosphere. The only possible sources of danger are glowing filaments of broken incandescent lamps, sparks from switches or commutators and glowing resistance wires; but as Heise and Theim have shown the great difficulty with which these give rise to an explosion, even in the presence of fire-damp mixtures, the risk of coal dust explosions caused by any form of electrical apparatus, used in coal mines, is said to appear to be absolutely non-existent.—*Colliery Guardian,* v. 79, p. 161; abstracted in *Brit. Inst. Civ. Eng. Abstracts,* v. 141, pt. 3.

Electric Power and Land Development Schemes.—MAVOR.—A communication calling attention to the importance of the element of increment in value of land to promoters of power transmission schemes. He says that the annual income earned by a pure electric power station leaves an exceedingly small margin for working expenses and profit. An electric power company ought to take up at the same time a commercial land development scheme. He adduces an example, where an electric power company purchased a piece of ground on which an industry now defunct had been carried on; before it had been impossible to let certain large buildings; they were easily rented when the company introduced an electric power supply to the tenants at a very

low scale, which would not give anything like an adequate return for the capital required for its production; on the other hand, the rents of these premises were such as to afford a very handsome profit to the company on the whole transaction. He further refers to the development of Niagara. His remarks are discussed in an editorial note.—Lond. *Elec.*, Aug. 31.

Magnetic Separation of Ores.—WEDDING.—A paper in which he describes two machines for sorting ores according to their magnetic properties. "In one of these the ore is carried on traveling bands, the magnets being underneath; the other consists of two horizontal electromagnetic circular cylinders, the upper one of which has a ribbed surface, the lower one being encased by a non-magnetic substance of a thickness equal to three-fifths the clear space between the metal of the rollers. The ore is passed through between the rollers as they are rotating in opposite directions, and becomes separated into three different lots, which fall onto aprons and into bins underneath and in front of the machine." Certain minerals on being roasted undergo a chemical change which renders them capable of separation by magnetism into their simple constituents. A means of separating many ores which in the dry state require the action of strong magnetism, is to place them in still or running water and then apply the magnetic forces, which thus become relatively much more powerful, as the action of gravitation on the minerals is partly suspended; this process, however, has not yet been practically wrought out. He also gives an account of the various means of rendering magnetically separated iron ores, which have of necessity been finely divided, suitable for the blast furnace by making them into briquettes with clay, lime, silica, coal, tar, pitch, petroleum and cellulose residue, etc.—*Verh. des. Ver. zur. Bef. des Gewerbefl.*, 1899, p. 155; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, pt. 3.

British Manufacturing Plant.—The first part of a long illustrated description of the British Insulated Wire Co.'s plant at Prescot, which manufactures paper insulated cables.—Lond. *Elec. Rev.*, Aug. 31.

Production of High Temperatures.—An article on the Goldschmidt process for the generation of intense heat by working aluminum with the oxides of other metals, and its applications, mentioned at different times in the Digest.—*L'Ind. Elec.*, July 10.

Paris Exposition.—A long, well illustrated description of an electric locomotive for main lines, exhibited by the General Electric Co., of Berlin.—*Zeit. fuer Elek.*, Aug. 19 and 26.

A continuation of the illustrated serial. In this part sets of machines, exhibited by German firms, are described.—Lond. *Elec.*, Aug. 31.

An illustrated description of the machines exhibited by the International Company of Electricity, of Liege.—Lond. *Elec. Rev.*, Aug. 31.

An illustrated article on the Nernst lamp exhibit.—*Elec. Rev.*, Sept. 8.

PERKINS.—An illustrated article on the machines exhibited by Lahmeyer & Co.—*El'ty*, Sept. 12.

New Books.

A TREATISE ON ELECTRIC LAW, covering the law governing all electric corporations, uses, and appliances, also all relative public and private rights. By Joseph A. Joyce and Howard C. Joyce. Banks Law Publishing Company, New York, 1900; pp. 1133; $6.50.

In the above-named volume the authors have endeavored to gather together for practical use the law as found in the constitutions, the statutes and the decisions of the various States, a knowledge of which is required to answer the questions which constantly arise in the legal departments of the corporations in the United States which use electricity, whether to convey messages by wire, to transport passengers and goods by rail, or to light the streets and houses of cities and towns.

Here we find in a single volume constitutional law as it affects corporations, and especially those which use the highways, as electrical companies do; something of equity jurisprudence, especially as it controls the issuance of injunctions and like remedies; much of the law of taxation; of nuisance and negligence; of master and servant; of common carriers and passengers; of the user of the highways and other travelers thereon; of municipal regulations and police powers; of the rights of land owners abutting on streets in their contests against the users thereof; the condemnation law, and something of the law of the incorporation of companies.

Each one of these subjects is a vast field, worthy to be treated in a book by itself, but the authors have seen that only a portion of each subject is especially or peculiarly useful to the electrical corporation, and with very good judgment they have selected the portions of each with a view to the practical usefulness of the work to officers and counsel of these corporations.

It brings the decisions down to date, and where novel questions have arisen during the past few years upon which the decisions of the States conflict, the authors have briefly reviewed the position taken in each of the several States. The chapters devoted to these reviews are especially valuable to the lawyer who, when he meets any question, only partly decided in his own State, needs a bird's-eye view of decisions in other States, where the question has been passed upon. The work is not a model of literary composition. It is probably not intended to be. There are portions of the work which could be easily condensed to its manifest advantage, and there are sentences and sometimes whole sections which might be eliminated as repetitious, but this criticism does not detract from the substantial value of the work, the latest and most exhaustive on its subject, and including the period from 1895 to 1900, which post-dates the monographs of Barnard, Keasbey and Croswell upon the same subject.

MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By John S. Reid and David Reid. New York: John Wiley & Sons, London: Champsan & Hall, Limited. 389 pages, 301 illustrations. Price, $3.00.

This is an excellent book, based essentially upon American practice, constituting in no mean degree a dictionary of mechanical art, for not only are the elements of design treated, with the addition of all the latest and best methods of drafting, but precise and careful definitions are given as to what each part is and does. So far as we know, it is essentially the first book issued by an American author covering the ground, and it must be warmly commended for its fullness, accuracy and suggestiveness. A feature of each chapter is the exercises given, by which the student's grasp of the information presented to his notice may be tested. The book may be considered as the next step from the book by one of the authors, "A Course in Mechanical Drawing," and it would certainly seem that grounded in one and a master of the other, the student will be thoroughly trained. It is probably a matter of deliberate choice, rather than of oversight, that no note is made of dynamo design or of the conventional symbols and outlines for electrical apparatus. It would, however, have been easy to include a comprehensive chart and one or two brief chapters.

BOOKS RECEIVED.

THE WATER SUPPLY OF THE CITY OF NEW YORK. By the Merchants' Association of New York: Isaac H. Blanchard Company, New York. 627 pages, with several maps.

LES DECHARGES ELECTRIQUES DANS LES GAZ. By J. J. Thomson, D.Sc., F.R.S. Work translated from the English, with notes by Louis Barbillon. Preface by Ch.-Ed. Guillaume. One volume, octavo; 41 illustrations. Librarie Gauthier-Villars. Price, 5 francs.

Kansas City Street Railway Convention Train.

The eastern committee charged with the duty of making transportation arrangements for the Kansas City annual meeting of the American Street Railway Association announces that the train will leave the New York Central station at Forty-second Street at 1 p. m. Sunday, Oct. 14, and Boston at 10:45 a. m. The united party will leave Albany at 4:30 p. m., and Cleveland at 3:35 a. m. on Monday, going then over the Big Four, and arriving at St. Louis at 6:45 p. m. It will leave St. Louis over the Wabash at 10:15 p. m., and arrive at Kansas City at 7 a. m. on Tuesday, Oct. 16, the opening day. The train will consist of Pullman cars, with dining car, and a special representative of the New York Central will accompany the delegation all the way. The rate is one and one-third fare on the certificate plan. Fare from New York, one way, is $31.75; sleeper, one way, $7.50. If the number will warrant, arrangements will be made for a special train from New York Sunday morning about 10 a. m., arriving at Kansas City Monday evening. The committee and Mr. Milton C. Roach, general eastern passenger agent of the New York Central, 1216 Broadway, therefore earnestly request an early notification from all who intend going, so that if possible the necessary plans for such a special may be made. The committee for New York are H. H. Vreeland, J. H. McGraw, Chas. W. Price and T. C. Martin; for Boston, Chas. S. Clark, 8 Oliver Street.

An Electric Stair Lift.

There can be no question as to the general interest in the subject of inclined elevators or stair lifts, intended to supplement vertical elevator service or to relieve the public from the necessity of mounting stairs in any place where the traffic is heavy and the stairs are long. From time to time we have illustrated these devices, whose vogue is already far greater than the unobservant would imagine. The method of their use on the stairways of the Manhattan Elevated road was depicted in these pages last week, and it is expected that a general application of them will be made for such work. At the Paris Exposition there are 28 of them, whose use in going from the ground floor to the galleries is limited only by the charge of 2 cents per brief trip. But it is obviously in such places as the crowded 400 department stores in the larger cities of this country, that their utility is greatest, as they come to the aid of delicate women and children, and render the upper floors as available for the sale and display of goods as any of the lower.

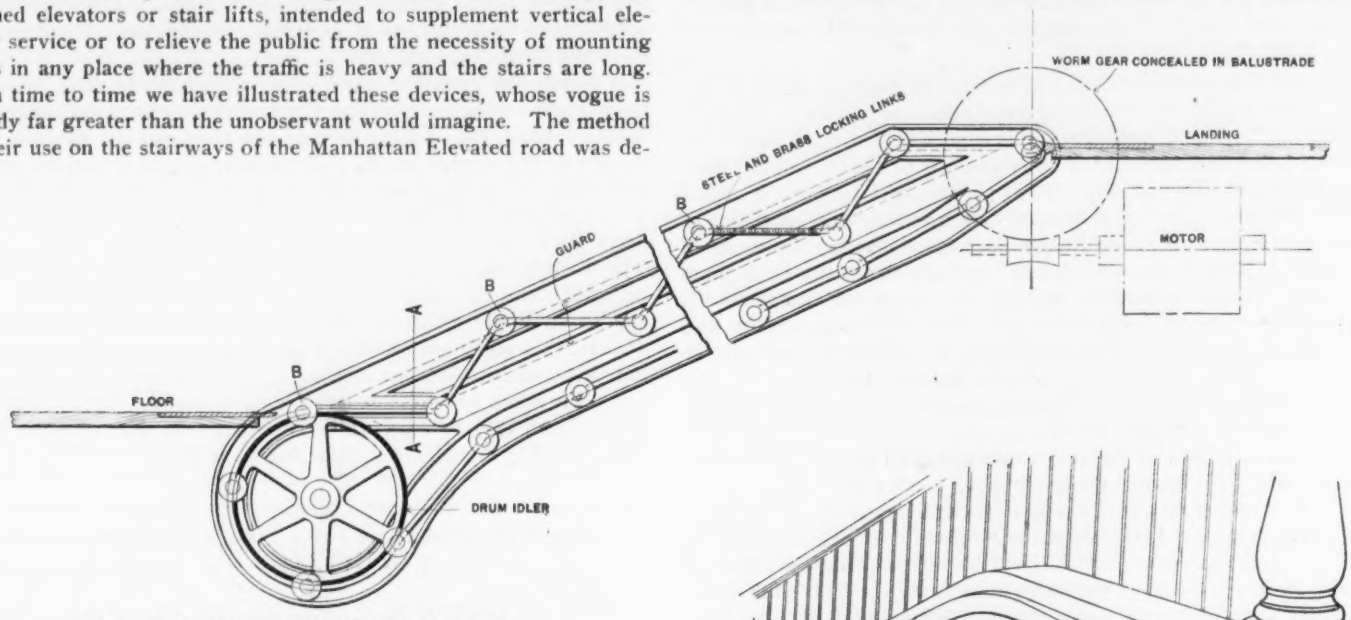


FIG. 1.—SECTIONAL ELEVATION OF STAIR LIFT.

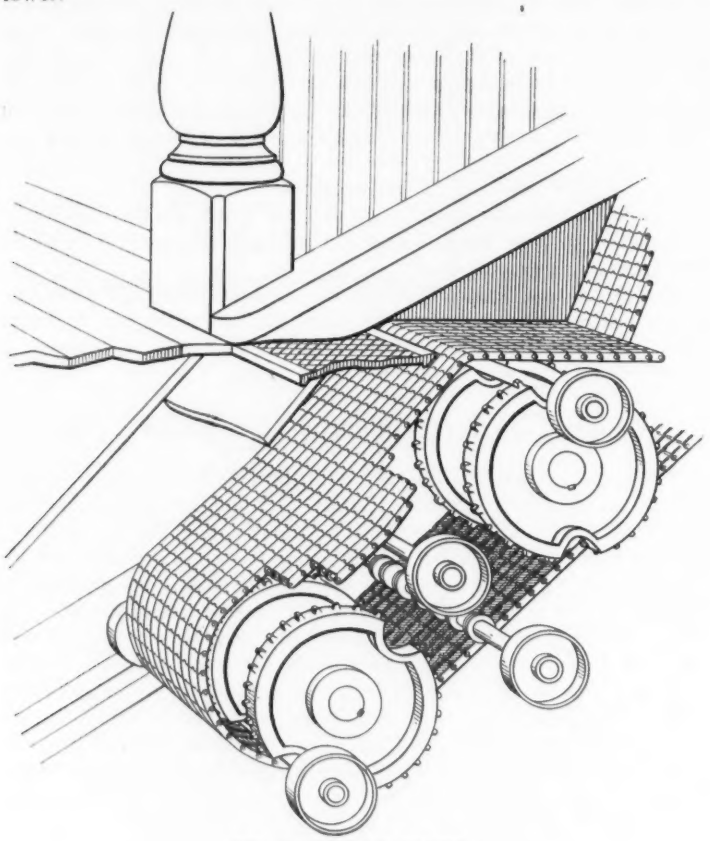


FIG. 2.—FOOT OF STAIRS.

Among those who have turned their attention to the many problems in this interesting field is Mr. James M. Dodge, so well known in connection with the Link Belt Engineering Company, of Nicetown, Philadelphia, who has brought to bear on the matter his vast experience gained in the development of belt conveying systems. We are afforded an opportunity to describe and illustrate his "Link Belt Stair Lift." It is shown diagrammatically in Figs. 1, 2 and 3, and perspectively in Figs. 4, 5, 6 and 7. It is intended to operate with a motor of 5 horse-power, at the head of the stairway, as seen in Fig. 1, and is carried around the drum idler at the foot of the stairs. The form of the normal staircase is followed, but instead of the fixed steps with flat tread and upright riser, a belt is used made up of steel and brass locking links, seen in greater detail in Figs. 2 and 3. These links allow flexibility in one position with rigidity in the other. Arranged along the belt, as at *B*, are pivots which carry at their outer ends rollers or wheels which fit into the fixed guideways at the side. In this manner the belt is deflected into level stretches which correspond to the treads of an ordinary stairs and into inclined portions which answer to the risers. There is no jump or lift, in the whole traverse. The treads from the time they emerge into view at the foot of the incline until

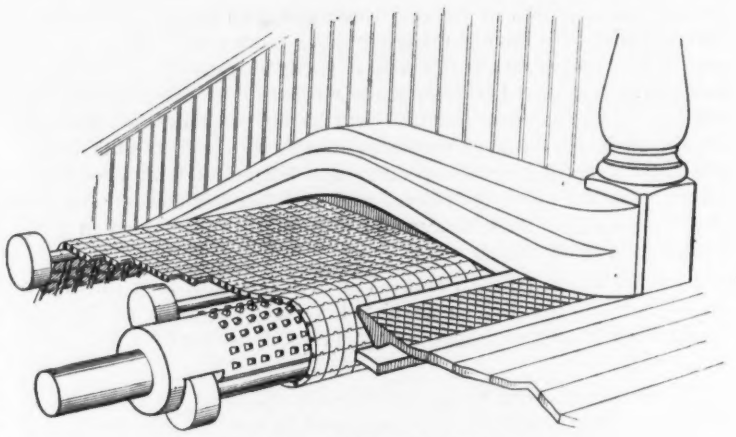


FIG. 3.—HEAD OF STAIRS.

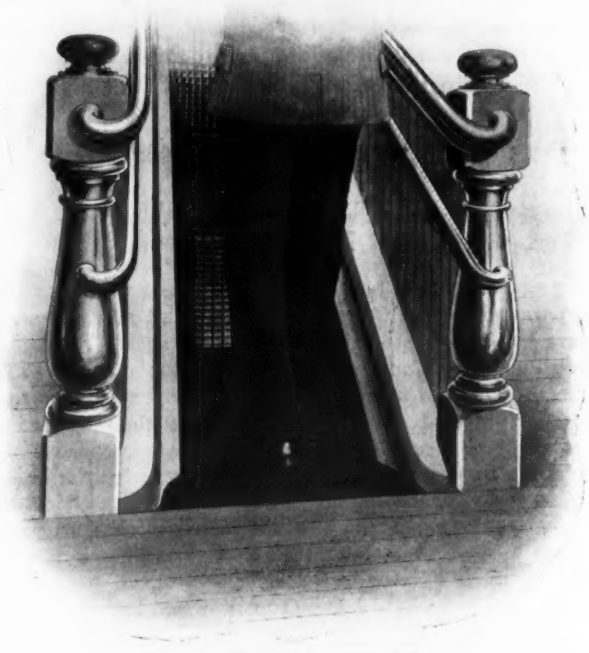


FIG. 4.—STARTING UPSTAIRS.

they reach the disappearing point at the top retain their same relative positions, moving upward with remarkable smoothness. The passen-

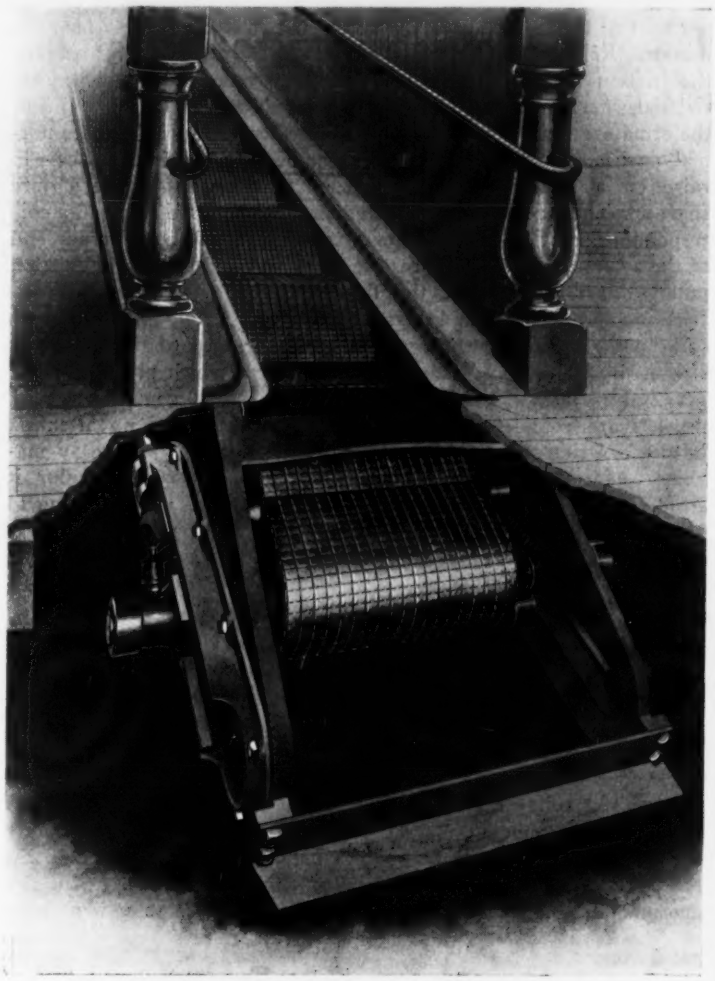


FIG. 5.—METHOD OF STAIR LIFT CONSTRUCTION.

gers step on the tread, it being impossible to step on the riser, and retain an easy position until the upper landing is reached, where they

FIG. 6.—LANDING.

are put off without jar or personal effort. The formation of treads and risers is thus automatic and continuous, and the belt as it leaves the landing bends around the sprocket and straightens out on the downward run underneath till it engages the foot shaft again, Fig. 5.

The act of travel on this stair lift is illustrated very well in Figs. 4 and 6. The pictures exaggerate, however, the incline to some extent, as it is only 26 degs. The tread itself is actually horizontal, and the passenger has literally no more trouble in retaining foothold on it than he would on an ordinary flight of stairs. It will be observed that in this method no moving handrail is used or needed. The level tread renders it unnecessary and leaves the passenger the free use of both hands. The plate at the top landing has a dull edge and just overhangs sufficiently to deliver the passenger gently and smoothly on the level. Traveling at the rate of 90 ft. per minute, with a passengen on each step, 3000 patrons per hour can be elevated without crowding or delay. No attendant is required, but it can be stopped in an instant from either floor, and by throwing off the current from the motor.

The stair lift from rail to rail is 3 ft. in width. The belt is only 21 ins. wide, tests having proved that a greater width does not give any increase in carrying capacity. It may be noted that large passenger elevators in one of the biggest railroad stations in this country show a maximum of 7 persons per minute in rush hours, whereas this apparatus at the speed mentioned above—90 ft. per minute—will handle between 40 and 50.

The method of use in a large store is shown in Fig. 7. The fact that the belt flattens out on its downward run, causes it to occupy a

FIG. 7.—STAIR LIFT IN DEPARTMENT STORE.

minimum of vertical space, while the self-oiling mechanism, motor, etc., are concealed in the landings, or floors, but are compact and accessible. The current required is so small as to make no perceptible difference in the load of a department store isolated plant, while it also affords the central station manager another outlet for current, if the store is on his circuits, at the time of day when his average load is lightest.

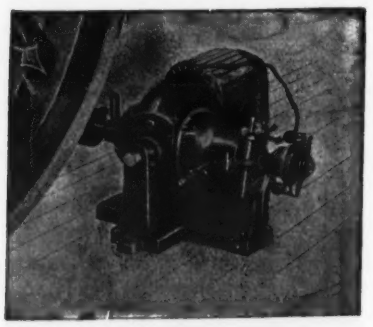
Incandescents and Welsbachs.

The following, from Mr. Walter Irving to the *Progressive Age*, will be of interest to many electric lighting readers: In the interest of the incandescent gas lamp business, I passed through certain sections of New York City and called upon a number of firms who were large consumers of the electric current, asking the individual parties why they used electricity to illuminate their windows while in the interior of their stores they preferred gas. In reply I was told that while electricity was very much more expensive, it was far more convenient to have in the window, as the latter could be dressed in any way desired and it would not interfere with the lighting up. With incandescent gas lamps, the window dresser would not only have to keep clear of them, which would not be an easy matter, but very little could be put in the window so as to give him plenty of room to stick a long taper through to ignite the lamps. They do not, I was told,

get the full candle-power from the electric lamps, and, therefore, the windows do not afford as good a display as would be the case if lighted by gas, but the latter makes it inconvenient to place articles in the window for display. Another storekeeper, when asked why he did not use gas instead of electricity, said: "I wish I could; I could pay my rent with the difference between the cost of electricity and gas, but I have no way of lighting the gas without crawling into the windows. This is my day for buying, so you will have to excuse me. If you get anything that will do the trick, come and see me." Still another, in answer to the same question, said: "I would use gas, and be glad to do it, but we have a large store here—four floors—and we cannot afford to keep the gas or lights burning all day. Take, for examples, our carpet, upholstery and rug departments. When customers go on that floor during the dull part of the day, there is very little light, so when they have made known their wants, the salesman takes them to that part of the store where the desired stock is kept, turns on the electric light switch, and then, right in that immediate vicinity, we have all the light that is needed; when through, he turns the switch again, and there our expense ceases. Now, with incandescent gas, we would have to burn the lamps all the time, which, even at a low flow, would be an expense not warranted, and if turned out, we should have to stop and light each one separately. To keep a customer waiting long enough to do this is too crude, is not up to date, and it would not be long before we should be considered a back number. Oh, yes, your light is bright, shows up colors well and is cheap, but one must be up to date and able to give customers immediate attention, you know, and you cannot take the same stand as you could if the delay were caused by large crowds and a rush of business." That afternoon's work of interviewing and getting the consumers' ideas has been worth while to me, for it induced me at once to overcome this common difficulty, and I have devised a system that I think will do all that can be asked. By it, a large window can be lighted all at once, as with electric light, or part of it, or the windows and the store at the same time. Half the store, or any part of it, can be lighted just as quickly as with electricity, and just as surely. The device does not shake and thereby break the mantles, and the lamps may be turned out or turned down, as desired; in fact, the system may give the electric light people a chance to cut prices to secure the business they now hold. The system is operated by a secondary or sparking coil connected with batteries, which I find is the best way to attain the object in view. It is my purpose, however, to call attention to the principal reason to my mind why electric incandescent lighting is so extensively used for store lighting in preference to incandescent gas lighting.

The Autosparker Gas Engine Igniter.

A well-known engineer is quoted as saying that most of the failures of gasoline engines on automobiles are "due to poor electrical engineering." That this statement is true, probably most of those who have had occasion to examine gasoline engine failures carefully will admit, and moreover the trouble is very often with the source of power for electric ignition. The falling off of battery current with age is a fruitful source of trouble, and the expense of battery renewals is an important item. Since magneto - generators and small igniting dynamos have come into use, the problem has not been entirely solved in a satisfactory way, because such machines directly connected with the engine by belt or otherwise will not generate sufficient energy when the engine is started by hand to ignite the charge, until the engine is nearly up to speed. If the engine were to be so geared up that it would ignite a charge at the first revolution by hand it would run many times too fast when the engine was at full speed. A battery has therefore been necessary to ignite the engine at first, and this means an outlay for battery maintenance. The Motsinger Device Manufacturing Company, of Pendleton, Ind., is manufacturing, and owns patents on, a device that makes dynamo ignition possible without the use of a battery. The dynamo made by this company is run by a friction drive from the engine fly-wheel. The dynamo is designed to run at about 800 r. p. m. when the engine is started, and as the speed increases a governor on the dynamo disconnects the friction drive a large enough per cent of the time so that the speed is kept still at 800 to 1200 per minute. Referring to the accompanying illustration of the dynamo, the friction wheel which runs against the fly-wheel is shown. This friction wheel is easily and cheaply replaceable. On the other end of the armature shaft is a governor which, when the speed reaches normal, pushes a taper sleeve in toward the bearing, causing the shaft to raise on a steel point, which raises that end of the armature shaft up. The machine being pivoted on a point at one end, and a corresponding point on the other end, this raising of the governor end of the armature shaft depresses the other end and brings the friction pulley down away from the fly-wheel. This action allows the friction wheel to touch and miss the fly-wheel just enough at all times to keep the desired speed, regardless of the speed of the engine or size of the fly-wheel. This is an arrangement which gives excellent practical results. In this machine the armature, commutator and brushes are completely enclosed. The brushes need no attention until worn out. The "Autosparker" is evidently a very easy machine to install, as there is no belt and no necessity of running it from a pulley that will give it the proper speed. The only thing to be done is to fasten the dynamo at the proper place next to the fly-wheel and connect it up to the igniter.



GAS ENGINE IGNITER.

Mail Collection Automobiles.

The subject of the collection of mail matter by automobiles is one to which the United States postal authorities have been paying considerable attention. The tests that have been made with a view to determine the advantages of the system have proved very satisfactory, while improvement and perfection in the vehicles will bring about even more striking results. The result of the general interest in the subject has stimulated the more progressive designers and manufacturers. We illustrate herewith a mail collection wagon, built by the Riker Motor Vehicle Company of Elizabethport, N. J. In this automobile Mr. Riker has aimed at a fine, close combination of the

AUTOMOBILE MAIL WAGON.

essential qualities, and has evolved a vehicle quite out of the ordinary, as will be gathered from the engraving. The weight is only 1850 pounds, the speed is 14 miles an hour, and the radius of action is 20 miles on one charge of battery.

The record of the work that such a vehicle can do is interesting. It appears that with one of them under test in Washington recently a postman collected the same quantity of mail as required by the other, old means, the services of two men for four hours. Work of this kind should not only determine the question as to the superior availability of the automobile, but do much to expedite mail service in the town and country.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call closed at 1½ per cent. Time money increased in activity and became firmer during the week, the closing rates being 3 per cent for 30 days, 3½ per cent for 60 days, 4 for 90 days to four months, and 4½ for five to six months. Mercantile paper was quiet. What has been reported of the stock market for the past few weeks applies equally well to last week's business. There was no perceptible improvement in activity or in the quality of trading. The public is not giving Wall Street any attention and shows no inclination to do so. Brooklyn Rapid Transit, among other stocks, was subjected to a bearish pressure, but the selling of this stock was unimportant. It was hammered down and closed with a net loss of 2 points. All of the other principal electrical stocks were weak and all closed with net losses, as follows: General Electric, ½; Metropolitan Street Railway, 5; Western Union, ½. In outside securities there was little of particular interest in trading, the total sales for the week not exceeding 5000 shares. General Carriage was probably the most active stock, orders seeming to come from insiders under an apparent effort to run up the price. Electric Vehicle experienced a sharp advance, which was attributed to probable changes in the directorate of the company. Large interests connected with the company, it is said, are from this time on to take a more direct part in the management of its affairs. Following are the closing quotations at New York, Boston and Philadelphia:

NEW YORK.

	Sept. 8.	Sept. 15.		Sept. 8.	Sept. 15.
Gen. Elec.	138½	138	Elec. Veh.	17	20
Bklyn Rap. Tran.	54½	52½	Elec. Veh., pfd.	40	..
Met. St. Ry.	154½	149½	Gen. Car.	6	6½
Am. Tel. & C.	88	..	Ill. Elec. Veh. Tran.	1	1¼
West. Un. Tel.	80	79½	N. Y. Elec. Veh. Tran.	7½	7½
Am. Dist. Tel.	25	25	N. E. Elec. Veh. Tr.	3	3½
Com. Cable.	166	168	Tel., Tel. & Co. of Am.	6¼	6
Elec. Boat.	17½	17	Hud. Riv. Tel.	..	116
Elec. Boat, pfd.	31	30	N. Y. & N. J. Tel.	160	160

BOSTON.

	Sept. 8.	Sept. 15.		Sept. 8.	Sept. 15.
New Eng. Tel.	..	..	Erie Tel.	96	97
Mex. Tel.	2	2	Gen. Elec., pfd.	139	140*
Westing. Elec.	46½	48*	Am. Tel. & Tel.	142½	142
Westing. Elec., pfd.	63	65	Ed. Elec. Lt.	..	..

PHILADELPHIA.

	Sept. 8.	Sept. 15.		Sept. 8.	Sept. 15.
Elec. Stor. Bat.	70	64	Phil. Elec.	..	2½
Elec. Stor. Bat., pfd.	..	90	Pa. Elec. Veh.	..	..
Elec. Co. of Am.	9⅜	9¼	Pa. Elec. Veh., pfd.	..	..
Gen. Elec. Auto	..	¼	Am. Rys.	..	..

*Asked.

U. G. I. PURCHASES.—Besides obtaining a large interest in the Norwalk, Conn., Tramway Company, the United Gas Improvement Company, of Philadelphia, has secured the Derby Street Railway Company. These two lines connect with the roads in and about Bridgeport, Conn., which the company purchased early in the year. The several lines will be turned into practically one system, connecting Bridgeport, Waterbury and New Haven, to be controlled and operated by the United Gas Improvement Company. The district traversed by the lines is essentially a manufacturing one, and is good territory. A special despatch from New Haven Conn., of Sept. 18, says: It was learned to-day that the United Gas Improvement Company, of New York and Philadelphia, would make an attempt in the coming Legislature to secure the right to establish an electric light plant in Bridgeport in opposition to the resident company. Allan W. Paige, of Bridgeport, is the Connecticut representative of the big trust, and it is said he will present the bill at Hartford. It is the purpose of the company to operate a cheap electric light plant in Bridgeport through the fine electric plant of the Bridgeport Traction Company, which is part of the trust, and to offer to light Bridgeport at a much cheaper rate than is now possible. The trust will also light Milford through the traction company's plant, and may attempt to operate in this city in the same way. It is the ultimate purpose of the trust to construct a dam on the Naugatuck River and build at that point an electric power plant that will be capable of operating electric roads and lighting cities and factories for 40 miles in any direction. Ultimately the whole of the Naugatuck Valley, which is now practically in the control of the New York trust, will be lighted and power furnished from one central power house. In Bridgeport the trust intends to start its campaign for the control of the State next winter. The Bridgeport and New Haven Electric Light Companies are now operated under the United Illuminating Company, and it is to oppose these resident plants that the trust will enter Bridgeport next winter.

GRAND RAPIDS, MICH.—The Grand Rapids, Grand Haven & Muskegon Railroad has been reorganized and proposes to build 41 miles of electric road between Grand Rapids and Muskegon, with the following officers: President, James D. Hawks; vice-president, Thomas F. Carroll; treasurer, Wallace Franklin; secretary, Joseph Kirwin. Mr. Hawks, who is at the head of the new company, is president of the Detroit, Ypsilanti & Ann Arbor Railway, which is one of the finest electric roads in the United States. Mr. Franklin is the Michigan representative of Westinghouse, Church, Kerr & Co., of New York. This firm will supply the complete equipment for the new line, which will be about forty-four miles in length and cost from $1,250,000 to $1,500,000. It cannot be stated yet where the power-house will be located, but it may be at Spring Lake, or near the center of the road. The track will parallel highways the whole distance and the private right-of-way is now being secured. The road will be of standard width and will be provided with not less than 200-hp motors for each car, so that it will be possible to make good time with heavy loads. Provision will be made for a double track. The power-house will be built this winter and the grading will be done before the freezing season, so as to give the advantage of the winter settling on the grade. The rails and ties will be distributed this winter, as the work can be done cheaper on the snow, and the track will be laid early in the spring, and thus be ready for next summer's business. About an 80-pound rail will be laid.

WESTERN UNION'S EARNINGS.—Considerable interest attaches to the quarterly report—the first for the new fiscal year—of the Western Union Telegraph Company, whose directors have just declared the regular quarterly dividend of 1¼ per cent on the stock. The figures showed net revenues of $1,600,000, a decrease of $66,567; an increase in the interest on bonds of $14,920, and a decrease therefore in the balance for the quarter of $81,847. The exhibit is interesting in view of the reports that a reduction in the dividend to a 4 per cent basis is contemplated. The figures are but another illustration of the remarkable absence of elasticity in telegraph earnings.

SALE OF NORWALK TROLLEYS.—The United Gas Improvement Company, of Philadelphia and New York, which has been purchasing trolley lines and gas and electric light plants throughout Connecticut, has just taken over the Norwalk Tramway Company, of South Norwalk, paying $30 a share for the $287,000 capital stock and taking all the bonds at par. The tramway company operates 20 miles of trackage, but has not paid the interest on its bonds in late years. Ex-Gov. T. M. Waller is president of the company. The law firm of Waller & Wagner, of New York, is the chief stockholder. The trust purchased the Norwalk Street Railway Company last year.

ELECTRIC VEHICLE.—The annual meeting of the Electric Vehicle Company was held Sept. 18. The acts of the Board of Directors were approved and all of its members were re-elected for the coming year with the exception of T. J. Taylor, who was replaced by Philip T. Dodge. No details of the business were given out at the time of our going to press. Mr. R. McA. Lloyd, president of the company, has returned from Europe.

BELL TELEPHONE.—It is stated that in the reorganization of the American Tel. & Tel. Co., Mr. John E. Hudson, of Boston, will be president; C. Jay French, of Boston, vice-president, and Mr. E. J. Hall, of New York, general manager. This is what might naturally be expected.

BROOKLYN EDISON MORTGAGE.—The Edison Electric Illuminating Company, of Brooklyn, has given notice that its first mortgage gold bonds, of the face value of $1,500,000, will become due Oct. 1 and will be paid at the Franklin Trust Company on presentation after that date.

DIVIDENDS.—The Western Union Telegraph Company has declared a quarterly dividend of 1¼ per cent. The United Traction and Electric Company, of New Jersey, has declared a dividend of 1 per cent, payable Oct. 1. The Union Elevated, of Chicago, has declared a dividend of $2 per share, payable Oct. 1.

GENERAL ELECTRIC DIVIDEND.—The General Electric Company has declared a dividend of 2 per cent on its common stock, payable Oct. 15, an advance of ½ per cent from the last previous payment in July. Quarterly dividends of 1½ per cent. on the present reduced common stock have been paid since July, 1899.

ELECTRIC LIGHT BONDS.—The Donaldson Bond and Stock Company, of St. Louis, was the highest, among eleven bidders, for the $17,000 4 per cent Kirkwood, Mo., electric light bonds. It bid $17,226.61. The bonds are of the denomination of $1000, and run twenty years, with the option of the city to pay in ten years.

DIVIDENDS.—The Metropolitan Street Railway Company, of New York, has declared a quarterly dividend of 1¾ per cent. The Philadelphia Traction Company has declared a regular semi-annual dividend of $2 per share, payable Oct. 1. The City Railway, of Dayton, Ohio, has declared the regular quarterly dividends of 1½ per cent upon the common and preferred stock, payable Oct. 1.

JOLIET STREET RAILWAYS.—The consolidation of Joliet-Chicago street railway lines with a capital of $1,500,000 and a bonded debt of the same amount, is being carried out.

THE GENERAL CARRIAGE COMPANY has, it is stated, made a contract with the Baltimore & Ohio Railroad by the terms of which it is given control of a part of the cab service of that company.

TWIN CITY.—The Twin City Rapid Transit Company has declared a regular quarterly dividend of 1¾ per cent.

Commercial Intelligence.

THE WEEK IN TRADE.—There was manifest last week an increasing demand at advancing prices in many lines of trade, particularly in cotton. From the West and Southwest came reports of expanding business, but in the East trade was slower in developing, although signs of expansion are not wanting. The only unfavorable feature of the industrial situation was the strike of the anthracite coal miners. Retail prices for coal have already been advanced, although large stocks of fuel were accumulated in anticipation of the strike. The iron and steel situation has not materially changed since last report, and irregularity in demand and prices is still a feature. Railway earnings continue to show prosperous business. The earnings of 105 roads for August, as reported to *Bradstreet's*, show a gain of 6.7 per cent over a year ago, and comparing with a gain of 5.9 per cent in July. Every group of roads shared in the prosperity. For the eight months the earnings of 105 roads show a gain of 12.3 per cent. *Bradstreet's* reports the number of failures during the week as 167 against 154 last week and 149 the corresponding week last year. R. G. Dun & Company compute the liabilities of the concerns failing for the two weeks of September at $4,284,812, against $3,303,830 the corresponding period last year. Copper, lake ingot, closed at 17c., and casting at 16¾c., with a good demand and strong tone.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week just ended: Antwerp—23 cases electrical material, $4034; 1 case motor trucks, $25. Aberdeen—3 cases electrical material, $400. British East Indies—25 packages electrical material, $1334. British Possessions in Africa—44 packages electric material, $2966. British Guiana—26 packages electric material, $786. Brazil—3 cases electric material, $48; 4 cases electric material, $1276. British West Indies—7 packages electric material, $131. Bristol—86 packages electric machinery, $10,135; 26 packages electric cables, $4433. British Australia—31 cases electric machinery, $2716; 226 cases electric material, $13,054; 270 trolley poles, $9700; 600 cable reels, $32,800. Copenhagen—6 cases electric cranes, $1400. Cuba—42 packages electric material, $1834; 8 cases electric machinery, $173. Central America—69 cases electric material, $1057. Chili—1 case electric material, $24. Catania—63 cases electric material, $12,504. Dutch West Indies—2 packages electric material, $38. Dutch East Indies—6 cases electric material, $261. Ecuador—1 case electric material, $15. Glasgow—54 packages electric cable and fixtures, $14,085; 2 cases electric material, $89. Hamburg—1 vel. motor car, $915. Havre—109 cases electric material, $5162; 8 cases insulators, $312. Hull—1 case motors, $180. Japan—111 cases electric material, $18,971; 7 cases motors and parts, $1006. Jarrow—52 packages electric material, $10,600. Leghorn—1 case electric material, $15. Liverpool—42 cases electric machinery, $2920; 9 cases electric material, $470; 75 cases trolley poles, $2200. London—80 cases electric machinery, $2374; 56 cases electric material, $11,673; 14 cases motors, $803. Mexico—101 cases electric material, $1479. Marseilles—9 cases electric material, $762. Manchester—1 case electric machinery, $300. Madrid—25 cases electric material, $3900. Newcastle—32 packages electric material, $1650. New Zealand—4 cases electric material, $72. Porto Rico—20 packages electrical material, $455. Philippines—42 cases electric machinery, $6125. Peru—58 packages electric material, $990. Riga—25 cases electric material, $429. Southampton—1 case electric machinery, $190; 11 packages electric material, $556. Siam—23 packages electric material, $395. St. Petersburg—1 case motors, $145. Tynemouth—2 cases electric material, $200. U. S. Colombia—8 packages electric machinery, $605. Venezuela—71 packages electric material, $426.

APPARATUS WANTED.—The Public Lighting Commission, of Detroit, Mich., is in the market for apparatus and will receive sealed proposals until Oct. 5. Specifications are on file in the Commission Office and a memorandum of data can be obtained on request. The following machinery will be required: One 800-hp triple expansion engine, 1 600-kw alternating generator, 1 200-hp induction motor, 1 150-light arc dynamo, 1 40-kw exciting dynamo, 10 switches, 17 meters for the switchboard. At present the station consists of one room 50 ft. x 150 ft., with a switchboard gallery across one end, 14 ft. from the floor. There are 5 engines belted to 20 dynamos of 100 open arc lamps capacity each. The design is to connect alternating generators to the engines and run the arc dynamos by motors, one motor to every two arc dynamos. In the south end of the room there is a space, 28 ft. x 30 ft., in which it is proposed to set the 800-hp engine connected direct to the 600-kw generator. Three arc lighting sets will be placed between the small engines and the wall, allowing a space of 12 ft. for switchboard purposes. Should contractors desire to submit bids on any other method of increasing the present capacity of the plant by using the present floor space, they must accompany such bids with plans and specifications showing the changes to be made, etc.

OIL LIGHTING FOR PARIS.—About a fortnight ago experiments were made in Paris with a new oil lamp which, it is said, will in certain portions of the city supplant gas, if not electricity. A number of these lamps, which are mounted upon elaborately designed wrought-iron pedestals, and which have a light of 1000 candle-power each, now illuminate the Quai des Tuileries. It is said that they adequately light up the Tuileries Gardens on one hand, while their rays are sent across the terrace to the water's edge, and on the other to the Quai and the Seine as far as the left bank to the Gare d'Orleans. The *Petit Parisien* says that if the experiment "of effectually lighting up the dense gloom of the Quai des Tuileries, which has been especially chosen for this purpose, is successful, as every one believes it will be, petroleum lamps will shortly replace gas and electricity in all the large squares and open spaces in Paris, and no doubt they will eventually be utilized for lighting the Bois de Boulogne." Although called the City of Light, Paris is a gloomy city at night, and will be gloomier when it gets back to oil. It smells badly enough of gasoline now.

GILBERT WILKES & COMPANY (Incor.) is the style of a firm which has established itself at Denver, Colo., to do a general electrical and mechanical engineering business, with a capital stock of $25,000. The company will also operate as contractors. The members of the firm are Gilbert Wilkes, of Denver, president; W. P. Stevens, of Detroit, vice-president; H. L. Woolfenden, of Detroit, treasurer; W. Van R. Whitall, of Denver, secretary, and Edwin Denby. The company is also carrying on business in the Union Trust Building at Detroit. Mr. Wilkes is well known in the electrical field and in the East and has for some time past been located at Detroit, his partner there being Mr. Woolfenden. It is a good sign for Western electrical development that this addition of Denver to their range of action should have been made. The headquarters in Denver will be in the Ernest & Cranmer Building.

TELEGRAPHONE PATENT RIGHTS.—Consul Worman writes from Munich that he has received inquiries from several parties in the United States as to the patent rights for the telegraphone, the owners thereof, etc. The Bank für Handel & Industrie, of Berlin, says Mr. Worman, represents the syndicate which controls the patents for this device. The managers have informed him that the patent rights in the United States have already been disposed of. The letter adds: "We thank you most sincerely for your kind offer to assist us by personal co-operation in the development of the telegraphone patents. We regret to have to inform you that we are not in a position to give you the exact information that you desire, as our attempts to produce the telegraphone in the highest possible perfection have not yet been successful."

AUGUST EXPORTS AND IMPORTS.—The August statement of the imports and exports of the United States, issued by the Bureau of Statistics, shows that during the month the total imports of merchandise were $61,626,005, a decrease as compared with August, 1899, of about $3,000,000. Of the imports of merchandise $22,568,806 was free of duty. The exports of domestic merchandise during the month amounted to $101,338,964, a decrease of $1,500,000. The gold imports for the month amounted to $3,099,857, a decrease of $2,292,000. The exports of gold aggregated $18,066,372, as against $2,099,062 for August, 1899. The silver imports amounted to $4,214,573, an increase of over $1,100,000, and the exports to $6,486,899, an increase of $2,500,000.

NEWBURG, N. Y., LIGHTING INTERESTS.—It is announced from Poughkeepsie, N. Y., that the Republican candidate for governor of New York State, Mr. B. B. Odell, Jr., has sold out his interest in the Consumers' Gas Company and the Consolidated Gas, Electric Light, Heat & Power Company, of Newburg, to a syndicate of which F. R. Bain, of Poughkeepsie, is a member. The transaction involved several hundred thousand dollars. When the companies are reorganized it is expected that Mr. Bain will be elected president and manager. The plants will be greatly improved. Engineers have been busy for several weeks looking over the ground and preparing plans.

STEEL AND WIRE COMPANY.—Denial is made of the report that the American Steel & Wire Company intends to build a $3,000,000 Bessemer steel plant at Waukegan, Ill. The company owns a large wire plant at that point, which formerly belonged to the Washburn & Moen Company. This wire mill was burned some time ago and recently it was rebuilt. It is said that the place is not a favorable one for the construction of a large steel plant.

PARAGUAY.—It is reported by the *Südamerikanische Rundschau* that the Paraguayan Government intends to equip the city of Asunción with modern water and electric lighting facilities. With this purpose in view an engineer from Buenos Ayres has been making the preliminary investigations.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has given a contract to the McClintic-Marshall Construction Company, of Pittsburg, for the construction of a brass foundry at East Pittsburg.

M. B. AUSTIN & COMPANY, Chicago, recently purchased the supply department of the Chicago General Fixture Company.

General News.

THE TELEPHONE.

THOMASTON, GA.—S. P. Miller & Company contemplate installing a telephone and long distance system.

NINETYSIX, S. C.—The Ninetysix Telephone Company, recently incorporated, has installed a telephone exchange.

WHATCOM, WASH.—A movement is on foot to connect Lynden and the mills on the Guide Meridian with Whatcom by telephone.

ANGOLA, IND.—The Steuben County Telephone Company has completed a line to Coldwater Mich., making a system of over 200 miles.

JACKSON, LA.—The exchange established here for the Cumberland Telephone Company was opened for business recently with 45 subscribers.

EAST ST. LOUIS, ILL.—The Bell Telephone Company has begun the erection of a building for its own use on Collinsville Avenue. It will cost $10,000.

LINCOLN, NEB.—The Edgar Telephone Company, Edgar, has been incorporated. Capital, $2,500. Incorporators: O. Edgar, S. W. Christy, both of Edgar.

CARLINVILLE, ILL.—The Macoupin County Telephone & Telegraph Company has let the contract for construction material, and work will begin in a few days.

THE ERIE TELEPHONE SYSTEM made a net gain of 2972 subscribers in August. Total number connected Aug. 31, 131,548. Number waiting connection, 3878.

GUTHRIE, O. T.—The organization of a local telephone company at Oklahoma City is on foot. The articles of incorporation of the company provide for a stock of $60,000.

BATAVIA, OHIO.—The Batavia Telephone Company has been incorporated. Capital, $5,000. Incorporators: W. R. Walker, J. W. Ransom, J. C. Ward, W. H. Baum, O. P. Griffith.

THE PACIFIC STATES TELEPHONE COMPANY made a net gain of 1550 subscribers in August. The total number connected is 78,852, which includes 19,819 in San Francisco.

LEADVILLE, COLO.—The Leadville Gas & Electric Company has been chartered. Capital, $200,000. Incorporators: J. F. Campion, C. K. Boettcher, R. B. Sullivan, G. Wilkes, all of Leadville.

ALLIANCE, OHIO.—After fighting with the Central Union Company for nearly two years, the Columbiana County Telephone Company has finally secured a franchise to install an exchange in Alliance.

MINERAL CITY, OHIO.—The Mineral City Home Telephone Company has been incorporated. Capital, $12,000. Incorporators: G. J. Markley, T. E. Wilson, E. Vankirk, J. L. Kenedy, C. D. Juvinall.

RENO, NEV.—The Reno fire alarm telegraph system was recently completed, under the supervision of Mr. A. J. Coffee, Pacific Coast manager for the Gamewell Fire Alarm Telegraph Company.

TIPTON, IND.—The Tipton Telephone Company is extending its lines to every town and hamlet in the county. Every farmer along the routes will be connected with the local and long distance lines.

BRAZIL, IND.—Samuel R. Markle, representing the Clay County Telephone Company, has been granted a 20 years' franchise for an exchange in this city, the wires in the business portion to be placed underground.

MUNCIE, IND.—The work on the switchboard in the Central Union Company's exchange in this city is completed. The Muncie exchange is pronounced second to none in the State in point of service and equipment.

NORFOLK, VA.—Since the announcement that the Southern Bell Telephone Company would double its rates in Norfolk, Va., it is stated that a new company will be organized by local capital to give cheaper rates.

FOSTORIA, OHIO.—The Citizens' Telephone and Message Company has increased its capital stock from $25,000 to $500,000. Improvements will be made. W. C. Beckwith is president of the company, and H. A. Tremaine secretary.

CIRCLEVILLE, OHIO.—The promoters of the Citizens' Telephone Company of this place are meeting with decided success in securing subscriptions to the new service, and contracts for the erection of the new exchange will be placed at once.

NORTH CONWAY, N. H.—The North Conway Telephone Company has been incorporated. Capital, $5000. Incorporators: C. E. Gibson, C. E. Poole, J. Z. Shedd, D. W. Barnes, A. Eastman, all of North Conway; C. E. Gibson, attorney, North Conway.

JEFFERSON, IA.—A large number of farmers residing in the northwestern portion of Guthrie County have organized a new independent telephone company, to be known as the Farmers' Mutual Telephone Company, and will at once commence the erection of a line.

TROY, OHIO.—The Progress Telephone and Telegraph Company has conveyed all franchises, instruments, appliances, lines and so forth, except the lines from West Milton to Pottsdam and Laura, to the Troy Telephone Company for a consideration of $5000.

INDIANAPOLIS, IND.—The first of the year the board of public works ordered the New Telephone Company to discontinue service. The instruments were never taken out, however, and the company is asking payment for service up to date. President Downing is making an effort toward an equitable adjustment.

CROSS FORK, PA.—The Cross Fork, Germania & Galeton Telephone Association, Cross Fork, has been incorporated. Capital, $3,000. Incorporators: Lackawanna Lumber Company, Pennsylvania Stove Company, both of Cross Fork; H. Schwarzenbach, of Germania; A. C. Green, of Wellsville, N. Y.; W. F. Rice, of West Branch.

NEW YORK, N. Y.—The American Duplex Telephone & Telegraph Company, of Charleston, has been incorporated to do a general telegraph and telephone business. Capital, $1,000,000. Incorporators: J. E. Scraggs, E. L. Wood, C. R. Burdette, A. H. Wilson, Jr., J. E. Chilton, all of Charleston; Chilton, MacCorkle & Chilton, attorneys, Charleston.

BUFFALO, N. Y.—The Ramson Electric Company, which is trying to secure a franchise to establish a telephone system in Batavia, will not be allowed to do so without a struggle, as the Board of Aldermen has received an invitation from the Bell Telephone Company to visit Niagara Falls and inspect both systems, which are in operation there, and see the difference.

GREENSBURG, IND.—The Greensburg Telephone Company has filed articles of incorporation with the Secretary of State. Capital stock, $50,000. The incorporators are A. P. Bone, W. B. Hamilton and D. A. Myers. The company proposes the erection of a line and to operate in Decatur, Franklin, Rush, Shelby, Bartholomew, Jennings, Ripley and Dearborn counties.

CHARLOTTE, N. C.—The combined interests of the independent telephone companies of the States of North and South Carolina are making a fight against the Bell Telephone Company in this territory. The independent interests are strongly organized as the "Independent Telephone Association of the Carolinas," with W. B. Moore, of Yorkville, S. C., as president.

MICHIGAN CITY, IND.—The Mutual Telephone Company of this city has asked the Laporte City Council for a franchise to erect and maintain a toll line in Laporte, which line will be in connection with the Michigan City system. The absorption of the local company at Laporte by the Central Union makes it necessary for the Mutual Company of this city to erect an independent line to Laporte.

LAPORTE, IND.—The Central Union Telephone Company has purchased the entire plant of the Laporte Telephone Company, operating a local system and toll lines to Michigan City, Westville, Chesterton, Valparaiso, Union Mills, Hanna and Kingsbury. By this move the Bell Company gains entrance to this city, where the Council had repeatedly refused it a franchise to operate in opposition to the local organization.

NEW AUGUSTA, IND.—The wires of the New Augusta Telephone Company have been connected with those of the New Telephone Company and service is had with Indianapolis. The New Augusta Company has 25 miles of wire stretched connecting with several junctions in the oil fields. The line will soon be extended to Traders Point, Flocksville and other towns. It also affords service to many farmers. It is a new concern. William B. McDonald is president.

FREEPORT, L. I.—At the recent annual meeting of the stockholders of the South Shore Telephone Company the entire board of directors was re-elected. The directors subsequently showed that the company is operating 40 miles of line, with a total of 358 subscribers, divided as follows: Freeport, 105; Rockwell Center, 69; Hempstead, 49; Roslyn, 29; Baldwins, 21; Lynbrook, 19; Mineola, 19; Long Beach, 11; Oceanside, 8; Hyde Park, 8; East Rockaway, 6; Merrick, 4; East Williston, 4; Greenwich Point, 3; Albertsons, 2; Uniondale, 1. The company has been granted a franchise for the extension of its lines into Oyster Bay town, and arrangements are about complete for the commencement of the work. After the line has been constructed, it is proposed to put in a central office at Sea Cliff. The directors met immediately after and elected the following officers for the next year: H. P. Libby, president and general manager; George W. Bergen, vice-president; William G. Miller, treasurer.

ELECTRIC LIGHT AND POWER.

FAYETTE, MISS.—An electric light plant will be erected here.

SCRANTON, PA.—The Dunmore Iron & Steel Company is equipping its shop with electric power.

RALEIGH, N. C.—The new electric plant being installed at the State penitentiary here has been completed.

WINONA, MISS.—The electric light and ice plant here was started on Sept. 1. The ice plant has a capacity of 20 tons.

AVA, ILL.—The Ava electric light plant was totally destroyed by fire Sept. 12. The loss will be $3,000, with no insurance.

RIVER FALLS, WIS.—The City Council has let the contract for the city electric light plant. The plant will cost $23,000.

CHRISTIANSBURG, VA.—The city will build an electric light plant. D. M. Munro, Washington, D. C., has prepared the plans.

PORT ARTHUR, TEX.—The Port Arthur Light & Gas Company will rebuild its electric light plant, which was lately burned.

TARBORO, N. C.—The new electric light company has begun operations here and the service is proving altogether satisfactory.

DICKINSON, N. D.—The Hughes Electric Light and Power Company has installed its new plant and is furnishing the city with light.

HENDERSON, N. C.—The Seaboard Knitting Mills at this place will put in an electric light plant. The contract for the work has not yet been let.

CHARLOTTE, N. C.—A 1000-hp electric plant will be established by the Roanoke Navigation & Water Power Company, near Roanoke Rapids, N. C.

HALLETSVILLE, TEX.—The city has contracted with the Dallas Electric Light Company to put in a new 1200 incandescent light plant by Nov. 1 for $3,300.

JEFFERSON, WIS.—At a special election it was decided that the city should buy the plant of the Jefferson Electric Light and Power Company for $25,000.

HENDERSON, N. C.—The Henderson Lighting Company has been chartered with a capital stock of $10,000. The incorporators are S. H. Pullian, E. V. Williams and J. H. Bridgers.

PALMER, MASS.—The Central Massachusetts Electric Company contemplates the building of a new boiler house at the plant in Blanchardville. The contract has not yet been awarded.

CHICAGO, ILL.—The American Lighting Company, of Chicago, has been

incorporated. Capital stock, $20,000. Incorporators: W. C. Jones, Keene H. Addington and William D. Murphy, Jr.

BERGEN COUNTY, N. J.—An increase of 60 per cent is reported by the Gas & Electric Company, of Bergen County, in the number of its consumers on Sept. 1, as compared with same date last year.

FAIRBURY, ILL.—The Fairbury Electric Light, Heat & Power Company proposes to rewire its system and needs some No. 6, No. 8 and No. 12 weatherproof wire. Mr. W. B. Decker is secretary.

CURWENSVILLE, PA.—The Curwensville Electric Company has been incorporated. Capital, $10,000. Incorporators: A. E. Patten, E. A. Irvin, F. J. Dyer, W. F. Patten, J. A. Frank, all of Curwensville.

EAGLES MERE, PA.—The Eagles Mere Electric Light Company has been chartered, with a capital stock of $7500. Active work will be started as soon as possible. Mr. B. G. Welch is general manager.

TOLEDO, OHIO.—The Maumee Valley Electric Company, of Toledo, has given a mortgage for $100,000. This money is for the purpose of securing the payment of bonds issued for construction and equipment.

SHELBYVILLE, ILL.—The City Water Company, with a capital of $112,500, has been incorporated, to operate water and electric plants. The incorporators are Henry C. Wood, Thomas C. Clark and James S. Handy.

LAFAYETTE, IND.—The West Lafayette Town Board has closed a contract with the Lafayette Electric Light Company to illuminate the streets of that town with 40 arc lights, including 5 for Purdue University campus.

TIFFIN, OHIO.—The City Council has awarded the contract for lighting the city to the Tiffin Edison Electric Illuminating Company and the Seney Electric Light Company. The contract is for three years at $80 per light per year.

SHAMOKIN, PA.—The Shamokin & Edgewood Light, Heat & Power Company, Shamokin, has been incorporated. Capital, $30,000. Incorporators: M. H. Kulp, G. G. Kulp, D. C. Kaseman, H. W. Shuman, W. J. Wiest, J. Reed, all of Shamokin.

ASPEN, COLO.—A deal was lately consummated by which the entire stock and plant of the People's Electric Light and Power Company passed into the hands of the Roaring Fork Electric Light and Power Company. The consideration is believed to be $50,000.

SAN FRANCISCO, CALIF.—The steamship Samoa, one of the German army transports now being fitted out for China in San Francisco, will be supplied with an electric lighting plant by the Risdon Iron Works. A distilling plant and other improvements will also be installed.

PLATTEVILLE, WIS.—The Platteville Electric Light & Power Company has just enlarged its plant by the addition of two 45-kw General Electric direct-current dynamos. The company is using for street lights a 30-kw General Electric alternator. Mr. J. H. Evans is manager.

SAN FRANCISCO, CALIF.—The City Hall dome, the Ferry Depot tower and portions of Market and Montgomery streets, San Francisco, have been wired and supplied with incandescent lamps for the illumination to celebrate the fiftieth anniversary of the admission of California to statehood.

SAN FRANCISCO, CALIF.—The Keswick Electric Power Company was recently incorporated, with San Francisco named as the principal place of business Directors: J. W. Blain, W. W. Marvin, S. J. Dean and H. A. Marvin, of San Francisco. Capital stock, $100,000; subscribed, $10.

ST. LOUIS, MO.—A temporary writ of injunction was granted Sept. 10 against the Seckner Contracting Company and various municipal officers, restraining that company from stringing wires in certain territories. It was issued on the petition of the Kinloch Telephone Company.

MILWAUKEE, WIS.—Mr. Otto Wallber has the contract to install a complete electric lighting plant for the Milwaukee Worsted Mill Company, of this city. The contract includes a 25-kw generator, direct connected to an Ideal engine; also complete switchboard and wiring up 300 incandescent lights.

GOSHEN, IND.—The report of the lighting plant of Goshen for 12 months shows that the receipts of the system were $9102 and the expenditures $5886, leaving a profit of $4017. The city has 125 arc lights, for which it paid $42.75 per light. The city also had the free use of 100 incandescent lights.

NEW KENSINGTON, PA.—The borough authorities have let a contract to the New Kensington Electric Lighting and Steam Heating Company, a new corporation, for the exclusive furnishing of electric lights to the borough. The contract calls for 40 or more 2000-cp arc lights, at the rate of $69 per year.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company proposes to increase its plant. Series alternating enclosed-arc lamps are to be introduced on the streets, and the company will probably be in the market for lamps and regulators or series transformers. Mr. J. J. Geiser is superintendent.

JAMESTOWN, N. Y.—It is proposed to enlarge the municipal electric light plant here by the addition of 50 alternating arc lamps, which are now needed. Other supplies needed for the plant include wires, poles, insulators, cross-arms and general material for construction. Mr. C. G. Sundquist is superintendent.

MEYERSDALE, PA.—The transfer of the property of the Meyersdale Electric Light, Heat & Power Company has been made, the consideration being $20,000. The new company, to be known as the Summit Electric Light, Heat & Power Company, with A. C. Fulmer as manager, has assumed control of the plant.

TROY, N. Y.—The Niskayuna Power Company has been incorporated to build and maintain canals in Schenectady and to lease and sell power developed from the flow of water. The capital is $100,000, and the directors are William A. Graves, of Rexford Flats, and Ernest C. Brown, William H. Fritchman, Henry K. Landis and Leslie J. Montgomery, of New York.

HOLTON, KAN.—The plant of the Holton Electric Company was entirely re-equipped last winter, at which time three new dynamos were installed and two new engines and two boilers, also one Cookson heater and purifier. In addition to this, the station was enlarged and the lines rebuilt. A new marble switchboard was also installed. Mr. W. E. Gant is manager.

SAN FRANCISCO, CALIF.—The Marysville and Nevada Power & Water Company expects to build a canal from the Feather River for electric power purposes. At a point 19 miles below the dam, 1800 horse-power can be developed under a 400-ft. head. A ditch and flume will then carry a portion of the water eight miles further, where 1200 horse-power can be developed under a head of 1200 ft., discharging into the Yuba River.

CINCINNATI, OHIO.—The Edison Company has introduced two ordinances in the City Council, one asking for a franchise to lay a complete underground system for supplying light, power and heat, and another for a franchise to erect poles and string wires for lighting purposes in portions of the city not designated heretofore in the lighting districts, including such contiguous territory as Avondale and other villages afterward annexed.

CRAWFORDSVILLE, IND.—The loss by fire on the municipal light plant has been adjusted and the insurance money paid. The plant will be enlarged, about $15,000 worth of new machinery being added. The plant has never paid expenses and municipal control proved a failure. The plant cost $105,000. The city has employed Thos. E. Stone as superintendent at a salary of $1500 per year and 25 per cent of the net earnings after all expenses are paid, he being allowed $50 per year for each arc light.

WALLINGFORD, CONN.—The Borough Electric Works (municipal) plant, which commenced operation Jan. 1 last, has at the present time in service 81 street arcs, 10 commercial arcs and 3500 incandescent lamps. The works have applications for nearly 900 incandescent lamps, and the plant is said to be operating on a very satisfactory basis. Mr. A. L. Pierce is superintendent and manager. Mr. Pierce states that the plant will be extended for commercial service. He needs some general supplies.

EGG HARBOR CITY, N. J.—This town has been without electric lights for nearly five months, as the Egg Harbor Electric Light Company has thrown up its contract with the city and the two parties have been unable to come to any agreement as to prices for lights. The town is small, and income from incandescent lights is not large enough to warrant running the plant, unless some business can be done with the city. Should the electric light company make a new contract with the city a new power equipment will be installed before winter, the present one being too small.

SAN FRANCISCO, CALIF.—The Ashburton Mining Company recently started up a 500-hp electric gold-dredging plant on Sailor Bar, near Folsom, Calif. The boat is 105 ft. x 40 ft. and 7 ft. in depth. Independent electric motors, of General Electric manufacture, drive the important parts of the dredging machinery. The work will be carried on continuously by three shifts of five men each. Three thousand cubic yards of earth can be handled per 24 hours. The dredge was constructed under the superintendence of Mr. William Stanton. The Sacramento Electric, Gas & Railway Company furnishes the electric power required to operate the dredges and pumps.

ALBANY, N. Y.—Articles were filed with the Secretary of State amending the certificate of incorporation of the Peekskill Lighting Company, forming it into the Peekskill Lighting and Railroad Company. The corporation, in addition to its lighting and power plant, will operate an electric railroad 25 miles long in Westchester County. The company will operate the roads running from Peekskill to Lake Mohegan, and from the Peekskill station to the State Camp ferry landing. and will construct a line from Peekskill to Verplanks Point. The capital is $500,000. The directors include B. B. Nostrand, Jr., and H. L. Armstrong, of Peekskill; Richmond Talbot, of Tuxedo; H. S. Morton, of Hoboken; H. H. Hobart Porter, Jr., of New York City.

SAN FRANCISCO, CALIF.—The Mammoth Electric Company was recently incorporated, with the object of transmitting electric power to San Francisco and other places. The members of the company are: H. G. Lacey, O. M. Lacey, R. C. Lacey, S. E. Biddle, J. E. Rawlins, J. S. Robertson and E. Kauntze, of Hanford, Calif., and J. S. Eastwood, of Fresno. The Messrs. Lacey are interested in the San Joaquin Electric Company, which transmits light and power to Hanford and Fresno. The new company has filed water rights on the upper San Joaquin River, and claims an ultimate capacity of 55,000 horse-power. A 12-mile flume will enable a working head of 2100 ft. to be utilized at the generating station. It is proposed to supply electric power in a wholesale manner to the large power companies in San Francisco. It is said that work will soon be commenced on the new system, which will require $2,500,000 to develop it to its ultimate capacity.

THE ELECTRIC RAILWAY.

WAYNESVILLE, OHIO.—John P. Martin, S. L. Cartwright and James Stoops, of this place, are promoting an electric road to run from Springfield to Cincinnati.

TOLEDO, OHIO.—The Board of Aldermen has passed an ordinance providing that the Toledo Traction Company shall sell six tickets for 25 cents on all lines and furnish universal transfers.

LEBANON, OHIO.—The Dayton, Lebanon & Cincinnati Traction Company, which is being projected by Dr. J. E. Lowes, of Dayton, has applied for franchises in Warren county and Lebanon.

AKRON, OHIO.—Cleveland and Akron capitalists have taken up the project of an electric road from this place to Canton, started some time ago by William A. Lynch, of Canton. T. L. Childs, of this place, is at present in charge of the project.

COLUMBUS, OHIO.—The officials of the Columbus, London & Springfield Electric Railway Company have reached an agreement with the city engineer as to the manner of constructing the roadbed of the line within the city limits. A compromise was effected on a bed of 6-in. concrete, with oak ties filled up to the sand cushion and extending over the ends of the ties.

QUEBEC, QUE.—The electric car service from the city of Quebec to La Bonne Ste. Anne has been successfully inaugurated. The cars run at the rate of 12 miles an hour, and there will now be 46 trains a day on the new line. The electric railway company owns all the property around the Montmorency Falls, and will shortly erect an elevator to take passengers from the railway to the head of the Falls. It is also proposed to erect a powerful search-light, which will be used to illuminate the cataract in colors at night.

ST. LOUIS, MO.—The new Channing Avenue line of the St. Louis Transit Company commenced operation on Sept. 9.

WATERLOO, IOWA.—The Waterloo and Cedar Falls Rapid Transit Company will erect repairing and construction shops in Waterloo.

ALLIANCE, OHIO.—After numerous delays, work is to be started at once on the construction of the Alliance, Sebring and Salem Electric Railway.

INDIANAPOLIS, IND.—The Broad Ripple Rapid Transit Company has decided to build an additional line from Indianapolis to Broad Ripple Park.

OAKLAND, CALIF.—The Oakland Railroad Company is welding the rails on the extension of its San Pablo Avenue electric line to University Avenue, in Berkeley, Cal.

NEWTOWN, PA.—Negotiations are under way for the sale of the Doylestown-Bristol trolley, operated by the Newtown Electric Street Railway Company, to the Bristol and Philadelphia Railway Company.

CANTON, OHIO.—The County Commissioners of Stark County have granted a franchise to the Stark County Electric Railway Company for a line along the highway between Canton, Louisville, Maximo and Alliance.

TOLEDO, OHIO.—The new Toledo, Fremont and Norwalk Electric Railway has opened a regular hourly schedule between Toledo and Fremont, the scheduled time for the 33 miles being one hour and fifty-three minutes.

CLEVELAND, OHIO.—The city Board of Equalization has raised the tax returns of the two street railway companies of the city. Nearly every item was increased. The companies will make an effort to contest the increase.

COLUMBUS, OHIO.—The Columbus, Buckeye Lake and Newark Traction Company has increased its capital stock from $100,000 to $1,000,000. W. O. Baker, of this city, is president of the company, and F. E. Pomerene secretary.

CLEVELAND, OHIO.—The Cleveland Electric Railway Company has commenced operating cars on its new line on Euclid Avenue, from Erie Street to Perry Street. East Cleveland and Euclid Heights cars will follow this route for the present.

PITTSBURG, PA.—The directors of the Steubenville, Mingo and Ohio Valley Traction Company contemplate putting in a complete telephone system which will practically connect the main office, power house and dispatcher's office with every car in use on the road.

PITTSBURG, PA.—The name of the West End Traction Company, of this city, which was recently purchased by Mr. M. K. McMullin, is to be changed to the Southern Traction Company, and a new charter is to be applied for. The change will take effect Oct. 1.

JERSEY CITY, N. J.—The mails between this city and Hoboken, Union Hill and Bayonne will be carried on the trolley cars of the North Jersey Street Railway and the Jersey City, Hoboken & Paterson Street Railway companies. The new system will be inaugurated in the near future.

HARRISBURG, PA.—The Philadelphia, Glenside and Willow Grove Railway Company has been incorporated, to build a line from Cheltenham to Abington Township, Montgomery County, a distance of six miles. The capital is $100,000, and Wm. T. B. Roberts, of Ogontz, is president.

AKRON, OHIO.—A car on the Silver Lake branch of the Northern Ohio Traction Company was wrecked recently by the motor breaking and forcing a part of the machinery up through the car floor. Several people were injured. This is the second serious accident on this line within a few weeks.

MEDIA, PA.—The Delaware County Commissioners have granted permission to the Philadelphia and Delaware Trolley Company and Prospect Street Railway, of Chester, to build two bridges on the Island road along the river front, between Philadelphia and Chester. They will cost about $60,000.

BUFFALO HUMP, IDAHO.—The proposed electric railroad from Buffalo Hump, Idaho, to Grangeville, has a prospect of being completed in about eight months. The road will be 50 miles in length. Mr. E. F. Gilpin, of Buffalo Hump, was recently in Spokane, Wash., perfecting his plans for construction.

MANSFIELD, OHIO.—The steel roof of the car barns of the Mansfield Street Railway Company collapsed a few days ago. Alterations had recently been made to the building, causing a weakening of the roof. The company is building a new power house adjoining the building and was planning to use the barns as an addition to the power house. The machinery which had been put into place was not damaged. The company will erect a new car barn on another site.

PITTSBURG, PA.—The employees of the United Traction Company celebrated their annual outing Sept. 5, at Calhoun Park. The attendance was estimated at 10,000. The day was a beautiful one and the crowd enjoyed itself hugely. A band was playing in the pavilion all day long. All kinds of athletic entertainments were held. In the evening there was dancing, and the party did not break up until late at night. Mr. J. D. Callery, the president of the company, as usual, took an especial interest in the success of the affair and he was present most of the day.

LORAIN, OHIO.—The City Council has settled the controversy existing between the Cleveland, Elyria and Western Electric Railway Company and the Sandusky and Interurban as to the position of tracks on West Erie Avenue, by instructing the former company to lay its north rail 3 ft. from the central line of the street, which would place it practically in the same spot as the north rail of the Sandusky company's line, making practically three tracks in the street, covering the same space the two tracks ordinarily would. The rails of the two companies will be about 6 ins. apart, however.

MUNCIE, IND.—Another effort is being made to construct the interurban traction line between this city, Dunkirk and Hartford City. Local capitalists, headed by A. L. Johnson and W. E. Hitchcock, have taken an interest in the project. An Eastern capitalist has made a proposition to build the road and turn it over to the stockholders in return for a stipulated amount of cash and bonds. Mr. Bromwell, chief promoter, has secured the right of way for almost the entire route, and is under bond to construct the road. It will take about $800,000 to build and equip the line. Small subsidies will be asked.

HAMILTON, OHIO.—The annual meeting of the stockholders of the Southern Ohio Traction Company was held here recently. A board of directors was elected, as follows: M. J. Mandelbaum, Jacob Mandelbaum, Will Christy, James D. Christy, A. E. Aikins, D. H. Kimberly, E. G. Tillottson, J. R. Nutt, Peter Schwab, G. A. Rentschler, F. T. Pomeroy and J. Lemprecht. Officers: Will Christy, president; M. J. Mandelbaum, first vice-president; Peter Schwab, second vice-president; F. T. Pomeroy, secretary and treasurer, and Will Christy and M. J. Mandelbaum executive committee. Improved service between Dayton and College Hill will be adopted at once.

COSTA RICA, C. A.—The city of San José has made a contract with the Costa Rica Electric Light and Traction Company by which it is authorized to extend its tramway to the street called Escasú, following the south side of the village of Sabana and parallel to the Pacific Railway's roadbed, in conformity with the plan presented by the Department of Public Works. The company is also authorized, should it so desire, to encircle with its line the village of Sabana and return to the city in accordance with the plans already approved, and which forms a part of the contract. The company shall in no case charge more than a 15 cent fare for any trip over its line. Uniformed postal and telegraph messengers, as well as policemen, shall be carried free.

CAMDEN, N. J.—The Camden, Gloucester and Woodbury Trolley Company and the Gloucester Electric Light Company have been merged into the South Jersey Gas, Electric and Traction Company. The main office will be in Camden and a sub-office of the trolley road in Gloucester. The new company will control the Moorestown Electric Light Company, Haddonfield Electric Light Company, Merchantville Electric Light and Water Company, Burlington Electric Light Company, Camden Gas Works, East Side Water Works and Woodbury Electric Light Works. It is intended to extend the Camden, Gloucester and Woodbury road to Pitman Grove and Clayton, to connect with Vineland and Millville roads.

THE AUTOMOBILE.

THE STANDARD AUTO-VEHICLE COMPANY, Newark, N. J., has filed articles of incorporation. The authorized capital is $250,000. The company will manufacture vehicles and motors.

THE CAPITAL CITY AUTOMOBILE COMPANY has been chartered at Washington, D. C., with a capital stock of $100,000. Incorporators: C. F. Norment, E. B. Evans, E. Reynolds, E. L. Wilson and others.

AUTOMOBILES IN STRIKES.—A despatch from Detroit says that President Mahon of the Street Railway Employees Association has been instructed to draft a plan by which the local unions are to be assessed for a fund to purchase automobiles for use by the street railway men during strikes.

THE SCOTT-COOPER MANUFACTURING COMPANY filed articles of incorporation at St. Louis, Mo., last week. The company is organized to manufacture automobiles and electrical devices of all kinds. The capital stock is $20,000. The incorporators are T. K. Cooper, A. D. Scott and F. H. Cooper.

THE CORONADO BEACH COMPANY proposes to buy automobile buses to replace its coaches and carryalls, used in transferring passengers from trains to the Coronado Hotel, and for excursion trips in the country adjacent to San Diego, Calif. Very powerful machines will be required to take the place of six and eight-horse vehicles.

AUTOMOBILE COMPETITION IN BOSTON.—The Massachusetts Electric Cab Company has established an automobile service in Boston. Its carriages are the product of the Woods Motor Vehicle Company, of Chicago. It is stated that there will be strong rivalry between the new company and the New England Electric Vehicle Company.

AUTOMOBILE AMBULANCES.—Four automobile electric ambulances are now building for private hospitals in New York. The Roosevelt, Presbyterian and New York hospitals are making the experiment. These ambulances are now completed and will be put in operation as soon as arrangements are made at the hospital stables for charging the machines. They are 7 ft. 6 ins. long.

GENERAL CARRIAGE COMPANY'S OFFICERS.—At a meeting of the stockholders of the General Carriage Company, New York City, on Sept. 14, these directors were elected: Cyrus Field Judson, Winfield S. Jewell, Joseph Leiter, Edwin M. Post, Louis Wormser, Camille Weidenfeld, Gen. Samuel Thomas and Robert J. McKinstry. Later the directors elected these officers: President, C. F. Judson; vice-president, Joseph Leiter; secretary, Edwin M. Post; treasurer, G. F. Thomas.

ASCENT OF PIKE'S PEAK.—A despatch from Denver, Colo., of Sept. 9, says: For the first time in its history Pike's Peak was yesterday ascended by an automobile, and John Brisben Walker, of New York, performed the feat. Although he did not go quite to the top, yet he made an ascent of 11,000 ft., the highest, it is said, that an automobile has traveled anywhere in the world. His only companion in the ascent and the descent was his son Justus, who has accompanied him on the Western trip. The road was in frightful condition.

ESSEX COUNTY, N. J.—At a meeting of the Essex County Automobile Club last week the following officers were elected: President, Kirk Brown, Montclair; vice-president, W. J. Stewart, Newark; secretary, Dr. H. Power, Upper Montclair; treasurer, H. W. Whipple, East Orange. The automobilists of Essex and neighboring counties who desire to join the club are invited to communicate with the secretary. Among the declared purposes of the organization are the holding of runs, mapping of routes, the promotion of good roads, and particularly of exerting influence for reasonable legislation governing the use of automobiles, and the defense of its members where their rights are assailed.

NEW INDUSTRIAL COMPANIES.

COLUMBUS, OHIO.—The Troy Electric Leasing Company, of Troy, has been incorporated. Capital stock, $25,000.

THE MAHONING MANUFACTURING COMPANY, of Mauch Chunk,

Pa., has been incorporated to manufacture artificial ice and electrical appliances. Capital stock, $30,000.

THE COOK ELECTRIC COMPANY, of New York City, has been incorporated. Capital, $10,000. Directors: S. S. Cook and Martha A. Cook, of Long Island City, and David Mason, of New York City.

THE REED AUTOMATIC TROLLEY HEAD COMPANY, Chattanooga, Tenn., has been incorporated. Capital, $1,000. Incorporators: E. M. Smith, E. S. Reed, W. P. McClatchie, H. Preston, W. C. Shelton, all of Chattanooga.

NEW YORK, N. Y.—The Telepher Company, of New York City, has been incorporated to manufacture wagons and vehicles. Capital, $4,000. Directors: Charles W. Coleman, E. T. Wastell and Anna L. Sorensen, New York City.

THE WITTE ARC LIGHT MANUFACTURING COMPANY, Jersey City, has been incorporated to manufacture electric arc lights, etc. Capital, $1,000,000. Incorporators: A. W. Perege, T. P. Payne, J. F. W. Drescher, F. C. Freeman, O. W. Ruland.

THE ELECTRIC ENAMELING COMPANY has increased its capital from $250,000 to $1,000,000. The head of the company, Charles H. Waterman, of Pompton Plains, has patented a process for enameling electrically tiling, brick and all kinds of metals. He says the enamel will prevent electrolysis in underground conduits. It is the company's intention to build a factory in New Jersey in the near future.

TELEGRAPHERS' CLUB.—Articles of incorporation of the Telegraphers, Stenographers and Typewriters of America have been filed with the Secretary of State of New York. It is proposed to band together all acceptable telegraphers, stenographers and typewriters for social and fraternal purposes and to maintain a club house in New York City. The directors are: Philip W. Staylor, of Baltimore; John H. Crain, of Chicago, and Earl A. Ramsey, James P. Cullen and Orvan H. Davidson, of Brooklyn.

PERSONAL.

MR. C. R. FISH has recently been engaged as salesman by the Stuart-Howland Company, of Boston, Mass.

MR. H. C. FRAZER, a representative of the Westinghouse Electric & Manufacturing Company at San Francisco, Calif., was a visitor in Pittsburg last week.

PROF. F. B. CROCKER is home from the joint Institute meetings and the International Electrical Congress, and has been busy with work at Columbia University.

MR. J. E. NICHOLAS has left the service of the Siemens & Halske Company to accept a position in the accounting department of the Gregory Electric Company, Chicago.

MR. C. H. HOOPER, who has long been identified with the Gregory Electric Company as cashier in the Chicago office, has gone to Phœnix, Ariz., in search of recreation and health.

MR. G. A. SCHIEREN, a son of ex-Mayor Schieren, and a graduate of Cornell, has gone into his father's famous Dixie Tanneries at Bristol, Tenn., to learn the practical details of the leather-making art.

MR. HUGO DIEMER, heretofore head of the mechanical department of the A. & M. College, Greensboro, N. C., has been elected assistant professor of mechanical engineering at the Michigan State Agricultural College.

MR. E. E. SCHWARZKOPF has tendered his resignation as editor of the *Automobile Magazine* to the receiver of the United States Industrial Company, which published it, and states that shortly after the close of the Trenton Fair he will start a new weekly called *Automobile Topics*.

MR. RUDOLPHUS FULLER, general manager and secretary of the Fuller Company, Detroit; Mr. E. H. Hargrave, of the Cincinnati Tool Company, Cincinnati, and Mr. R. A. G. Hubbard, of Hubbard & Hall, Cincinnati, Ohio, visited Chicago in the interests of their respective companies this week.

MR. C. T. YERKES, the American street railway magnate, is credited with having bought the franchise and all rights of the Charing Cross, Euston & Hampstead Railroad, one of the new underground enterprises in London. It is to be a four-track electric road, with some 10 stations. The cost of construction is put at $12,000,000.

MR. R. W. POPE, secretary of the American Institute of Electrical Engineers, who has been representing that body abroad very actively in all the recent exercises, returned last week. From Paris he made a trip to Geneva to see Mr. S. D. Field's electric railway work there, and returned to England by way of the Rhine and Belgium.

LOEWENTHAL—TRIER.—The marriage occurred on Sept. 19, in New York City, of Mr. Max Loewenthal to Miss Elizabeth Trier. The wedding ceremony took place at the Tuxedo at noon, and the happy pair then departed for a honeymoon South. Mr. Loewenthal is well known in electrical and journalistic circles, and a host of friends wish him and his bride all prosperity.

EDUCATIONAL.

ELECTRICAL LABORATORY.—The new electrical laboratory at Clemson College, S. C., is about completed, and is said to be one of the best equipped laboratories in the South.

PRATT INSTITUTE.—The courses of study in the department of Science and Technology of the Pratt Institute, Brooklyn, N. Y., are described in a circular of information just issued. This institution gives a two-year course in steam and engine design and applied electricity. These courses are not intended, however, to train expert engineers or specialists. They are especially intended to prepare young men for manufacturing or industrial pursuits. The aim is to make the work thoroughly practical and to simplify class room and theoretical work so as to require no mathematics higher than trigonometry.

ELECTRICAL CLASS.—The American Institute of New York City, as its announcement in our columns would indicate, makes a liberal appropriation in support of a special effort to give practical instruction to those who are desirous of obtaining an electrical education of that character, at a comparatively small expense to he individual. The class sessions begin Wednesday, Oct. 3, and will be held in the evenings from 6 to 8 o'clock daily, excepting Friday, Saturday and Sunday. On the third Friday of each month a public lecture is given in the large hall of the Institute by men of standing in the electrical and allied fields. These lectures are illustrated by lantern slides or experiments. Visits to central stations and electrical plants of interest will be made under the guidance of an engineer familiar with each, so that members may acquaint themselves with the latest practice in installation, operation and maintenance. The Institute has set aside quarters and supplied apparatus for laboratory work, which will form a special feature of the course.

UNIVERSITY OF MICHIGAN.—Prof. Herbert C. Sadler, B.S., late of Glasgow University, Scotland, has reported for duty at the University of Michigan and will begin work in the new course in naval architecture and marine engineering at the opening, Sept. 25. Professor Sadler is well known to the naval architects of this country, many of whom have been his associates or under him as students at Glasgow. He is a man of charming personality and unquestionably will find a warm welcome from students and colleagues in his new field of labor. He received his training in one of the principal shipyards of the Clyde and at Glasgow University, of which he is a graduate. For the last four years he has been assistant to Professor Biles, who is well known in America, and has been associated with him in his practice as a consulting naval architect. The course of instruction in naval architecture, which is arranged as a graduate course, will commence at the second semester of the senior year and extend to the end of the fifth year. At the end of the senior year, students may receive the degree of bachelor of science in engineering, and at the end of the fifth year that of master of science. For this year only, a special course has been arranged which will extend from the commencement of the coming semester to the end of June. In the future the course will be that already prescribed, *i. e.*, will extend over one and one-half years. The work will consist of lectures, drawing and visits to shipyards, and will in general follow the course given at Glasgow. Lectures will be given upon Ship Calculations, Strength of Ships, Resistance and Propulsion, Stability and Rolling, Ship Design, Practical Shipbuilding and Marine Engine and Boiler Design. In the drawing class each student will perform all the calculations connected with a vessel, and will also prepare one or more designs, including complete plans and specifications. A circular descriptive of the course of instruction may be had by addressing Professor Sadler direct, or the Dean of Engineering Department, Ann Arbor.

Trade Notes.

THE GARVIN MACHINE COMPANY, New York, is sending to the trade a circular containing illustrations showing its latest improved line of milling machines.

OIL FILTERS.—The Burt Manufacturing Company, Akron, Ohio, manufacturer of the Cross oil filter, has just received a duplicate order from the Carnegie Steel Company.

THE HARRISBURG BOILER & MANUFACTURING COMPANY, Harrisburg, Pa., is making large shipments of its products to South Africa, Peru, Mexico and other foreign countries.

AWARD ON TELEPHONE EXHIBIT.—The Telephone Manufacturing Company, Sumter, S. C., has received the medal of highest award on its telephone exhibit at the Paris Exposition.

MACHINE TOOLS.—The Woodward & Rogers Company, Hartford, Conn., in a pamphlet just issued, illustrates and gives the principal dimensions of its line of power drills. A copy of this catalogue may be had on application.

MESSRS. KLEMM & COMPANY, 132 North Fifth Street, Philadelphia, Pa., illustrate and give dimensions and prices of the American Reflector Company's reflectors for electric light, suitable for use in churches, hotels, theatres, stores, etc.

CONDUIT CATALOGUE.—The Electric Appliance Company, Chicago, is general Western agent for Richmondt electro-galvanized conduit. It has lately gotten out a conduit catalogue, which should be in the hands of every electrical worker.

WATSON-STILLMAN COMPANY, 204 East Forty-third Street, New York, in catalogue No. 60, just brought out, shows jewelers' and die-sinkers' hydraulic tools. The features of these tools are briefly pointed out and well illustrated.

MAXWELL M. MAYER ELECTRIC COMPANY, maker of the Mayer plating dynamos, etc., Second Avenue and East 121st Street, is desirous of obtaining agents in different cities. It is now bringing out an enclosed and a semi-enclosed dynamo.

RECORDING ELECTRICAL INSTRUMENTS AT PARIS.—The Jury of Award at the Paris Exposition has granted the Bristol Company, Waterbury, Conn., a silver medal for its exhibit of recording electrical instruments, and given honorary mention for its recording steam and pressure gauges.

TIC-A-TOC GREASE CUP.—James L. Robertson & Sons, 204 Fulton Street, New York, describe and illustrate in a little pamphlet the Tic-a-toc automatic grease cup. This device gives a positive, automatic, even and unvarying feed. Lubrication starts and stops with the starting and stopping of the engine.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., is offering to send samples of its "SU" type motor-starting rheostats, with automatic "no-voltage" release, for examination and test, to be accepted or returned, as desired. These rheostats are furnished for ¼ to 2 horse-power inclusive, 125 and 250 volts, with slate front 6 ins. x 6 ins.

RONEY MECHANICAL STOKER.—The Westinghouse Companies' publishing department has just issued a leaflet giving a list of recent purchasers of Roney mechanical stokers, with the total boiler horse-power, which will be installed when the present orders are completed. In the list are found eight orders from three companies and orders for five, four and three from many other concerns.

RAILWAY BANK ACCOUNTS.—The effect of railway electrical bonds on the bank accounts of electric railways is pointed out in the pamphlet issued

recently by the Harrington Rail-Bonding System, 120 Liberty Street, New York. Several illustrations are given showing the methods of applying the Olympia rail-protected bonds, which are made with round wires, permitting flexibility in all directions.

ELECTRICALLY DRIVEN PRESSES.—The Mutual Label & Lithographic Company, San Francisco, recently awarded a contract for 58 direct-current C & C motors and nine alternating-current motors. The motors will be operated under a multiple voltage control system and will be direct-connected to the presses, etc. Two direct-current generators, of different voltages, will be driven by a large induction motor to supply current for the motors.

THE AMERICAN ELECTRIC FUSE COMPANY, Chicago, Ill., has opened offices and stockrooms at 116 Nassau Street, New York. This office will be under the charge of Mr. W. B. McCurdy, who has been connected with the company for several years. The company will carry at the New York office a complete stock of all goods manufactured or handled by it, and shipments will be made from there direct to customers giving orders to that office.

GENERAL ELECTRIC BULLETINS.—Two recent bulletins issued by the General Electric Company's supply department, relate to "Artificial Light for Manufacturing Purposes" and "Grooved Trolley Wire." These bulletins are gotten up in the company's standard style and are judiciously illustrated. The bulletin on "artificial light for manufacturing purposes" contains illustrations of several cotton mills where General Electric arc lamps are installed.

BUCKEYE LAMPS.—The Buckeye Electric Company reports that there is an excellent demand for its specialty, the "Buckeye" incandescent lamp. Working on the thory that illumination is the basis of investment in an incandescent lamp, the company is building a special cellulose filament which is guaranteed to produce an average 16-cp illumination for an average burning period of 600 hours. The Chicago branch carries a large stock of lamps, insuring immediate delivery.

EXHAUST FANS.—The American Blower Company, Detroit, Mich., is making a line of exhaust fans for the removal of smoke and fumes; for use in connection with special heating and drying plants and for other uses. The various styles of fans made by it are described and illustrated in a pamphlet issued by the company. The company also manufactures steam engines, upright or horizontal, single or double automatic or throttling governors, and heating apparatus for factories and public buildings.

A LARGE LEATHER BELT.—The Bodifield Belting Company, of Cleveland, recently shipped to the Wabash Paper Company, of Wabash, Ind., one of the largest leather belts ever produced in this country. It was 151 ft. in length, 64 ins. wide and weighed 2500 pounds. It was made of three thicknesses of leather from the very best steer hides, and necessitated the using of the centres of 360 hides. The sale was more remarkable from the fact that the belt was made, packed and shipped within 43 hours after receipt of order.

COCHRANE HEATERS.—The subject of heating and purifying water for boiler feed and other purposes is always an interesting one to engineers and owners of steam plants. The Harrison Safety Boiler Works, Philadelphia, Pa., in a neat catalogue just isused, points out the advantages of Cochrane heaters and illustrates the construction of these devices. The different forms of heaters and separators are illustrated by perspective and diagrammatic views. The catalogue contains 60 pages, and the subject matter is presented in a very artistic manner.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has recently issued a set of bulletins illustrating and describing small alternating-current induction motors, revolving automatic switches, alternating-current, single-phase power motors, induction sewing-machine motors, polishing and grinding lathes fitted with alternating-current motors, alternating-current exhaust fans, cooking outfits for domestic use, dental and surgical air pumps, and electric hack saws. The principal features of these various devices are pointed out briefly and illustrated.

THE SHELBY ELECTRIC COMPANY.—The annual meeting of the Shelby Electric Company was held at the main office of the company, Shelby, Ohio, on September 4. There was a large attendance, and the steady growth of the business was highly commended by the stockholders. Some time ago one of the old directors resigned, and in his place the board of directors elected Mr. J. C. Wormley, manager of the Eastern department, for the unexpired term. At the annual meeting the choice of the board of directors was confirmed, and Mr. Wormley was re-elected as a director of the company.

ELECTRIC POWER.—The Westinghouse Electric and Manufacturing Company has issued a very handsome catalogue, illustrating many applications of its electric motors for industrial purposes. The right-hand pages contain illustrations of typical machines or actual installations, and the character and location of the apparatus are explained on the opposite page in four languages, namely, French, English, German and Spanish. The catalogue is gotten up in a very artistic manner, its purpose being to illustrate Westinghouse motors applied to stationary service. It is intended for distribution at the Paris Exposition.

MINIATURE LAMPS.—"High-grade decorative and miniature lamps for all purposes" forms the subject of a neat pamphlet just brought out by the American Endoscopic Company, Providence, R. I. The catalogue contains 40 pages and many illustrations of the various forms of small lamps, including surgical lamps, dental lamps, series lamps, etc. This company has its own lamp department, and every lamp made by it is guaranteed as to vacuum, etc. It also handles a line of specialties, including electrical bicycle lamps, hand electric lamps and electric head reflectors with miniature battery for illuminating all the cavities of the human body.

MR. GEO. F. ROHN, Milwaukee, Wis., has secured the contract for a complete electric lighting equipment for the Chamber of Commerce and Mitchel buildings, in that city. There will be two units, as follows: One 30-kw Milwaukee electric generator, direct connected to an Ideal engine, and one 75-kw Milwaukee electric generator, direct connected to an Ideal engine. The contract includes a complete switchboard and the wiring of the buildings. Mr. Rohn is also building several switchboards, among which is one for the Wisconsin Central Railroad's new power plant at Fond du Lac, Wis., and one for the Christensen Engineering Company for its new power plant at the new shops.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, Congress and Green Streets, Chicago, announces, in a circular which it is distributing in the telephone trade, that it is in a position to furnish telephone apparatus, guaranteeing the same to embody the latest modern principles, highest grade of material and as manufactured by the most skillful workmanship. It offers to its customers and prospective customers the benefit of a well-organized and competent engineering department to suggest the most suitable apparatus, as well as the best methods of arranging telephone circuits. The company is prepared to furnish large and small exchange and toll line boards for any system; also any parts of telephone apparatus.

THE BROADWAY CHAMBERS BUILDING.—In a recent communication to the Bullock Electric Manufacturing Company Messrs. George A. Fuller Company, contractor for the Broadway Chambers Building, New York City, a model of which is exhibited at the Paris Exposition, states: "Your dynamo forms a prominent feature of our exhibit, and helped to obtain the grand prize and gold medals which have been awarded to this exhibit." Prospective purchasers would serve their own interests by investigating the Bullock dynamos and motors before placing their orders. Descriptive and illustrated bulletins are furnished free upon request to the Bullock Electric Manufacturing Company, St. Paul Building, New York City.

AUTOMOBILE TIRE PUMPS.—The use of pneumatic tires for vehicles has given rise to minor industries for the supply of parts and apparatus. An important accessory is the air pump. This apparatus has undergone much improvement, especially since the introduction of the automobile with its inflated tires. The Gleason-Peters Air Pump Company, Houston and Mercer Streets, New York, has recently published a catalogue containing illustrations and descriptions of such of its pumps as are suitable or especially constructed for makers and users of pneumatic-tired vehicles. The pumps adapted for automobiles are made of malleable iron with heavy seamless brass tubing and steel plunger rod, and by means of a toggle-joint lever the leverage on the piston rod increases as the resistance on the piston increases. The company makes pumps and appliances for all purposes where compressed air is required.

SLOTTING ARMATURES.—The slotting of the old type, smooth body armatures of alternators, changing them to the toothed late types, is being done with great success by the Gregory Electric Company, Chicago, in its repair department. This company is equipped with all the machinery, punches, dies and forms necessary to do this work on all the standard sizes of all the leading makes and thereby increase the capacity of a 35 to 37½-kw alternator to 60 kilowatts and a 60-kw machine to a 100-kilowatt, without changing speed, frequency or voltage of the same. Each disc is punched out separately and practically a new armature is constructed following the very latest ideas. Self-oiling bearings are also furnished by this company for all of these machines, and in this manner its customers are modernizing their plants at comparatively slight expense. The Gregory Electric Company claims to be the pioneer in this work. It has brought it to a high state of perfection, and can guarantee results.

AUTOMOBILE EXPOSITION.—The preparations for the two automobile shows, which are to be held in New York next November, are going forward toward completion. The first show in point of time will be held at Madison Square Garden from Nov. 3 to Nov. 10. This will be followed by a show at the Grand Central Palace from Nov. 14 to Nov. 24. There is an abundance of space at the Grand Central Palace, and the display will give an uncommon opportunity for the trade to reach the people. The Grand Central Palace Exhibition will be held simultaneously with the Horse Show at Madison Square Garden. Mr. Marcus Nathan is manager of this exposition, and he points out the fact that the visitors to the Horse Show will naturally pass from that to the Automobile Show, and that the comparison between the motor vehicles and the latest modern driving turnouts will be favorable to the former. There will be a large representation of automobiles, and many of the firms manufacturing that class of vehicles have already arranged for large exhibits.

ELECTRIC HEATING.—The Simplex Electrical Company, Cambridgeport, Mass., has just issued its sixth catalogue descriptive of miscellaneous electrical heating apparatus which indicates by comparison with previous years the steady growth of the company's electric heating business. The catalogue contains 54 pages and shows illustrations of electric cooking utensils and heating devices for all purposes. The company points out that all good apartment houses of the future will be provided entirely with electricity for cooking and ironing. Many hotels, sanitariums, hospitals, etc., are now using electric cooking and heating apparatus to a considerable extent, and tailors, cloth manufacturers, etc., are already appreciating the advantages of electrically heated devices in their work, and thousands of irons are now in use. The company makes 14 styles of street car heaters alone, and its product of special electric heating apparatus is a very considerable item. The list of electrical heating and cooking apparatus is a long one, and those concerned will find a great deal of matter of special interest in the catalogue.

CHAS. H. BESLY & COMPANY, of 10 and 12 North Canal Street, Chicago, write us: For some years, as you know by these trade notes, we have been sending metal-working tools to India. We began by sending a few tools, and those small ones. The Indian machinist seems to have trouble in lubricating his machinery (they have only just begun to use Helmet oil). The first machines we sent had most of the boxes cut up in a few months; we find after they spoil one or two bearings they take better care of them. Last year we sent to Bombay a 20-inch lathe. The Indian must have known he was liable to have trouble with the bearings, for he ordered an extra set of bronze boxes. He has told us, however, that he has not yet been obliged to use them. He told us one thing about this lathe which surprised us, that native mechanics for more than a hundred miles around Bombay came to see the lathe on account of its size and the work it does. The lathe was not made by ourselves, but by Mr. Porter, of Massachusetts. During the past month we have sold outfits for three shops to go to India. American tools are preferred in India, and the demand seems to be increasing.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED SEPT. 11, 1900.
[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

657,510. PERFORATOR KEYBOARD; C. L. Buckingham and E. Germann, New York, N. Y. App. filed Jan. 13, 1898. A perforating machine, which is adapted to punch holes in paper strips in two rows, to form groups representing either the Morse alphabet, an alphabet by which messages may be transmitted and reproduced in typewritten characters, or groups of holes of any desired arrangement.

657,516. MOTOR VEHICLE; C. J. Coleman, Chicago, Ill. App. filed Oct. 27, 1899.

657,541. DEVICE FOR FIXING INCANDESCENT ELECTRIC LAMPS; L. J. P. Hollub and H. Mignal, Paris, France. App. filed May 29, 1900. Consists of a T-shaped portion (through which pass the leading-in wires) formed upon or applied to the head of the bulb, and a spring socket for retaining the T-shaped part in place.

657,574. HIGH-VOLTAGE INSULATOR; Alf Sinding-Larsen, Frederiksvaern, Norway. App. filed Dec. 11, 1899.

657,623. ICE-REMOVING TROLLEY FOR ELECTRIC RAILWAYS; J. J. Shirkey, Chicago, Ill. App. filed April 30, 1900. Provides a supplemental wheel to run ahead of the trolley wheel and operate a vibratable arm which is adapted to strike against the trolley wire.

657,637. TROLLEY-HEAD; S. Bourgeois, Manchester, N. H. App. filed April 10, 1900. The pole has a trolley-head disposed at an angle thereto so as to stand normally in a substantially horizontal plane, which head has pivoted thereto an oscillatory yoke in which a trolley wheel is mounted.

657,638. SECONDARY-BATTERY PLATE; William Bowker, Sr., Waltham, Mass. App. filed Jan. 19, 1900.

657,646. APPARATUS FOR RECLAIMING TIN AND ZINC FROM TINNED AND ZINC SCRAP; G. B. Cruickshank, H. R. S. Coleman and P. Cruickshank, Birmingham, England. App. filed May 23, 1900. Relates to the use of a chemical solution and electricity, together with certain structural details.

657,730. ELECTRIC-RAILWAY SIGNAL; George H. Dunham, Quincy, Mass. App. filed Nov. 11, 1899.

657,732. COUPLING FOR ELECTRIC CONDUITS; E. S. Francis, Hartford, Conn. App. filed July 6, 1900. Comprises a tubular portion adapted to be secured to a connecting-box, and an integrally formed semi-cylindrical part and a detachable semi-cyclindrical cover plate forming a clamp for the conductor.

657,736. ELECTRIC FURNACE; W. S. Horry, Sault Ste. Marie, Mich. App. filed Nov. 23, 1897. Provides for the continuous delivery of carbid, and embraces a movable furnace bottom adapted to support the weight of the contents of the furnace and of the product, and devices constructed and arranged to cut off the finished product as it is delivered from the furnace.

657,757. ELECTRIC BOND FOR RAILWAY RAIL; H. P. Brown, Montclair, N. J. App. filed Feb. 18, 1899. Consists of a bond plate arranged to overlap the meeting ends of rails, the plate having conducting plugs which project into bodies of plastic alloy lying in cups in the rail or rail support.

657,760. ELECTRIC IGNITER FOR EXPLOSIVE ENGINES; Isaac H. Davis, Boston, Mass. App. filed Nov. 18, 1899.

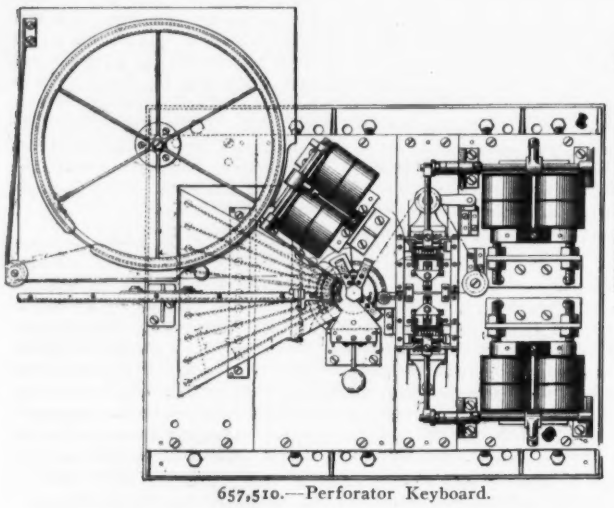
657,782. ELECTRIC ELEVATOR; John W. Mabbs, Chicago, Ill. App. filed July 26, 1897.

657,795. ELECTRIC CIRCUIT CLOSER FOR LOOMS; H. W. Smith and W. H. Redding, Worcester, Mass. App. filed July 13, 1898.

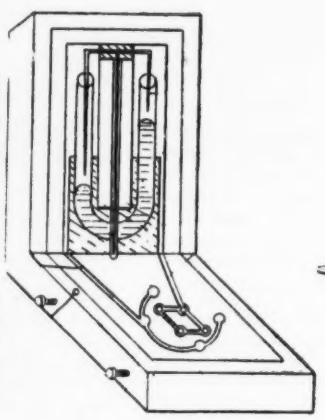
657,804. TIP FOR COMMUTATOR SEGMENTS; A. R. Westerdahl, New York, N. Y. App. filed May 31, 1900. Details.

657,828. SYSTEM OF MULTIPLE-RATE METERING; E. Oxley, Lynn, Mass. App. filed July 31, 1899. Comprises a supply circuit and a multirate metering device with means for fixing its rate of registration from a distant point. There is also a circuit for automatically restoring the rate for which it is set if disturbed.

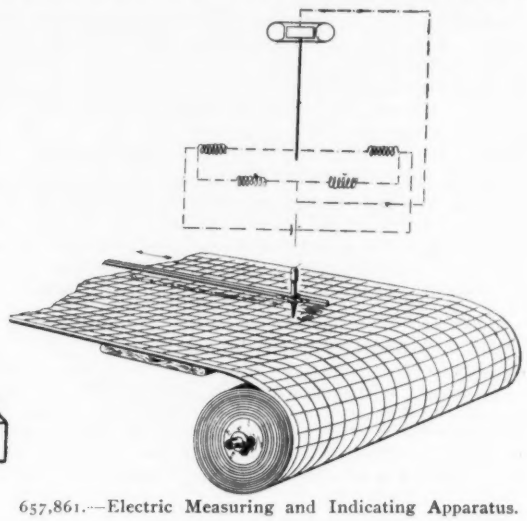
657,829. MULTIRATE METER; E. Oxley, Lynn, Mass. App. filed Aug. 7, 1899. Relates to control system for multirate meters by which any one of a plurality of meters at a consumer's station may be thrown into operation at a desired time, and particularly to means whereby interference with the system in case of an accidental ground may be prevented.



657,510.—Perforator Keyboard.



657,672.—Protective Device Against Burglary.



657,861.—Electric Measuring and Indicating Apparatus.

657,659. SECONDARY BATTERY; A. Jamieson, Elizabeth, N. J. App. filed Nov. 18,1897. A process of producing electrodes for electric accumulators which consists in applying a plastic mixture consisting of lead carbonate and water only to a supporting-plate, then drying and with a suitable electrode treating the same as a cathode by an electric current in a solution of carbonate of soda, whereby the carbonic acid is eliminated and a spongy but non-disintegrating metallic lead is produced ready for use without compressing.

657,672. PROTECTIVE DEVICE AGAINST BURGLARY; A. Petternel, Siedenhirtel, Austria-Hungary. App. filed Nov. 7, 1899. The walls of the chamber to be protected are provided with separated grooves containing rarefied or compressed air, so that a puncture in the wall will either admit or permit the escape of air. This action tends to disturb the level of mercury in U-shaped tubes, causing an electric circuit to be completed and give an alarm.

657,678. SECONDARY ELECTRIC CLOCK; G. P. Rose, Jr., Dubuque, Ia. App. filed Oct. 30, 1899. Details of construction.

657,694. ELECTRIC CLOCK; G. Fichter, Lynn, Mass. App. filed Jan. 10, 1900. Details.

657,703. ELECTRICAL RHEOSTAT; H. W. Leonard, New York, N. Y. App. filed Feb. 11, 1899. A rheostat composed of a shallow box, one side of which is made of insulating material and carries the resistance and contact plates. The resistance lies in the inside of the box embedded in a mineral insulating material, which insulates the sections and prevents overheating by absorbing the heat.

657,722. MEANS FOR CONTROLLING EXCITATION OF BOOSTERS FOR GENERATOR FIELDS; J. Appleton, Philadelphia, Pa. App. filed March 30, 1899. Provides means for controlling the excitation of the field of a dynamo-electric machine or booster which comprise a source of current other than said dynamo or booster, and a resistance connected across said source of current and to different points of which a field coil is connected.

657,830. CONDUCTOR AND COLLECTOR FOR ELECTRIC RAILWAYS; A. Petzenburger, Berlin, Germany. App. filed Dec. 8, 1899. A three-phase conductor is located within a normally closed casing, the casing having elastic flaps covering the entrance thereto, which may be spread apart by the passing current collector. The collector has a separate arm for each phase of the conductor.

657,853. ELECTRIC LOCK; H. G. Carleton, New York, N. Y. App, filed Jan. 13, 1900. The mechanism for moving the bolt or keeper is normally inoperative, and a controller actuated by electrical means is provided to render the mechanism operative.

657,854. COMBINED TELEPHONE SIGNAL AND JACK; Oren R. Cline, El Dorado, Kan. App. filed Feb. 6, 1900.

657,861. ELECTRIC MEASURING AND INDICATING APPARATUS; H. Darwin, E. H. Griffiths and W. C. D. Whetham, Cambridge, England. App. filed May 29, 1900. The essential feature of this invention is the employment of a circuit capable of motion when a current passes through it; for example, the coil of a D'Arsonval galvanometer, such circuit being so arranged that it automatically sets itself into a position where "balance" is obtained—that is, where no current flows through it, thus indicating the amount of some electrical quantity.

657,887. ELECTRIC TRAIN SIGNAL DEVICE; J. F. Scullen, Chicago, Ill. App. filed Jan. 26, 1900. Relates particularly to the details of a coupling for electric conductors between cars of a train, the cars being wired separately for signaling purposes.

657,892. ELECTRICALLY ACTUATED SAFETY DEVICE FOR ELEVATORS; N. B. Keyser, Philadelphia, Pa. App. filed Oct. 29, 1897.

657,899. MOTOR-VEHICLE; Clyde J. Coleman, Chicago, Ill. Ap. filed Oct. 27, 1899.